

CONSOLIDATED VERSION



Automatic electrical controls – Part 2-5: Particular requirements for automatic electrical burner control systems



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REDLINE VERSION



**Automatic electrical controls –
Part 2-5: Particular requirements for automatic electrical burner control systems**

CONTENTS

FOREWORD.....	4
1 Scope and normative references.....	7
2 Terms and definitions.....	9
3 General requirements.....	17
4 General notes on tests.....	17
5 Rating.....	18
6 Classification.....	18
7 Information.....	20
8 Protection against electric shock.....	23
9 Provision for protective earthing.....	23
10 Terminals and terminations.....	23
11 Constructional requirements.....	24
12 Moisture and dust resistance.....	31
13 Electric strength and insulation resistance.....	31
14 Heating.....	32
15 Manufacturing deviation and drift.....	33
16 Environmental stress.....	34
17 Endurance.....	34
18 Mechanical strength.....	37
19 Threaded parts and connections.....	38
20 Creepage distances, clearances and distances through solid insulation.....	38
21 Resistance to heat, fire and tracking.....	38
22 Resistance to corrosion.....	38
23 Electromagnetic compatibility (EMC) requirements – Emission.....	38
24 Components.....	38
25 Normal operation.....	38
26 Electromagnetic compatibility (EMC) requirements – Immunity.....	38
27 Abnormal operation.....	38
28 Guidance on the use of electronic disconnection.....	39
Annex H (normative) Requirements for electronic controls.....	40
Annex J (normative) Requirements for thermistor elements and controls using thermistors.....	58
Annex BBA (informative) Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable.....	59
Annex BB (informative) Specific regional requirements in Japan.....	60
Bibliography.....	61
Figure 101 – Pulse spark generation.....	23
Figure H.101 – Voltage variation test.....	44
Table 1 (7.2 of edition 3) – Required information and methods of providing information.....	21

Table H.1 (7.2 of the previous edition)	41
Table H.101 – Timing of short-term supply voltage variations.....	44
Table H.103 – Peak voltages.....	49
Table H. 104 103 – Test levels for electrostatic discharge.....	51
Table BB A.1 – Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable	59

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AUTOMATIC ELECTRICAL CONTROLS –

Part 2-5: Particular requirements for automatic electrical burner control systems

FOREWORD

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This Consolidated version of IEC 60730-2-5 bears the edition number 4.1. It consists of the fourth edition (2013-11) [documents 72/922/FDIS and 72/929/RVD] and its amendment 1 (2017-08) [documents 72/1084/FDIS and 72/1103/RVD]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60730-2-5 has been prepared by IEC technical committee 72: Automatic electrical controls.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2-5 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the fourth edition (2010) of that publication. Consideration may be given to future editions of, or amendments to, IEC 60730-1.

The title of IEC 60730-2-5 Ed. 4 has been updated to the title of IEC 60730-1 Ed. 5.0. However, IEC 60730-2-5 Ed. 4.0 has not been updated in accordance with the technical requirements in IEC 60730-1 Ed. 5.0.

This part 2-5 supplements or modifies the corresponding clauses in IEC 60730-1 so as to convert that publication into the IEC standard: Safety requirements for automatic electrical burner control systems.

Where this part 2-5 states "addition", "modification", or "replacement", the relevant requirement, test specification or explanatory matter in Part 1 should be adapted accordingly.

Where no change is necessary, this part 2-5 indicates that the relevant clause or subclause applies.

In the development of a fully international standard, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The "in some countries" notes regarding differing national practices are contained in the following subclauses:

- 2.3.127
- 6.11
- 15.7
- 17.16.102.1
- H.26.11.103
- Table H.21, Note 7

In this publication:

- 1) The following print types are used:
 - Requirements proper: in roman type;
 - *Test specifications: in italic type;*
 - Explanatory matter; in small roman type;
 - Words defined in Clause 2: **bold**.
- 2) Subclauses, notes, tables and figures which are additional to those in Part 1 are numbered starting from 101, *additional* annexes are lettered AA, BB, etc.

A list of all parts of the IEC 60730 series, under the general title *Automatic electrical controls* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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AUTOMATIC ELECTRICAL CONTROLS –

Part 2-5: Particular requirements for automatic electrical burner control systems

1 Scope and normative references

This clause of Part 1 is applicable except as follows:

1.1 Scope

Replacement:

~~This part of IEC 60730 applies to automatic electrical burner control systems for the **automatic control** of burners for oil, gas, coal or other combustibles for household and similar use including heating, air conditioning and similar use.~~

~~This part 2-5 is applicable to a complete burner control system and to a separate **programming unit**. This part 2-5 is also applicable to a separate electronic high-voltage **ignition source** and to a separate **flame detector**.~~

~~NOTE—Separate **ignition devices** (electrodes, **pilot** burners, etc.) are not covered by this part 2-5 unless they are submitted as part of a burner control system. Requirements for separate ignition transformers are contained in IEC 60989.~~

~~Throughout this part 2-5, where it can be used unambiguously, the word "system" means "burner control system" and "systems" means "burner control systems".~~

~~Systems utilizing thermoelectric flame supervision are not covered by this part 2-5.~~

~~**1.1.1** This part 2-5 applies to the inherent safety, to the manufacturer's declared **operating values, operating times** and **operating sequences** where such are associated with burner safety and to the testing of automatic electrical burner control systems used in, on, or in association with, burners.~~

~~NOTE—Requirements for specific **operating values, operating times** and **operating sequences** are given in the standards for appliances and equipment.~~

~~Systems for equipment not intended for normal household use, but which nevertheless may be used by the public, such as equipment intended to be used by laymen in shops, in light industry and on farms, are within the scope of this part 2-5.~~

~~This part 2-5 applies to systems using NTC or PTC thermistors, additional requirements for which are contained in Annex J.~~

~~This part 2-5 does not apply to systems designed exclusively for industrial applications.~~

~~**1.1.2** This part 2-5 applies to **manual controls** when such are electrically and/or mechanically integral with **automatic controls**.~~

~~NOTE—Requirements for manual switches not forming part of an **automatic control** are contained in IEC 61058-1.~~

~~Throughout this part 2-5, the word "equipment" means "appliance and equipment".~~

This part of IEC 60730 applies to automatic electrical **burner control systems** for the **automatic control** of burners for oil, gas, coal or other combustibles intended to be used

- for household and similar use,
- in shops, offices, hospitals, farms and commercial and industrial applications.

This International Standard is applicable

- to a complete **burner control system**,
- to a separate **programming unit**,
- to a separate electronic high-voltage **ignition source**,
- to a separate **flame detector** and
- to a separate **high-temperature operation (HTO) detector**.

NOTE 1 Throughout this document, where it can be used unambiguously, the word "system" means "burner control system" and "systems" means "burner control systems".

NOTE 2 Throughout this document, the word "equipment" means "appliance and equipment."

This standard does not apply to thermoelectric flame supervision controls; thermoelectric flame supervision controls are covered by ISO 23551-6.

This document also applies to electrical **burner control systems** intended exclusively for industrial process applications e.g. those applications covered by ISO TC 244 (ISO 13577).

1.1.1 This document applies to the inherent safety, to the declared **operating values**, **operating times** and **operating sequences** where such are associated with burner safety and to the testing of automatic electrical **burner control systems** used in, on, or in association with, burners.

NOTE Requirements for specific **operating values**, **operating times** and **operating sequences** are given in the standards for appliances and equipment.

1.1.2 This document applies to AC or DC powered systems with a rated voltage not exceeding 660 V AC or 600 V DC.

1.1.3 This document does not take into account the **response value** of an **automatic action** of a **control**, if such a **response value** is dependent upon the method of mounting the **control** in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer applies.

1.1.4 This document applies also to systems incorporating **electronic devices**, requirements for which are contained in Annex H.

1.1.5 This document applies to systems using NTC or PTC thermistors, additional requirements for which are contained in Annex J.

1.1.6 This document includes systems responsive to flame properties and temperature for HTO.

~~1.2 Replacement:~~

~~This part 2-5 applies to systems with a rated voltage not exceeding 660 V and with a rated current not exceeding 63 A.~~

~~1.3 Replacement:~~

~~This part 2-5 does not take into account the **response value** of an **automatic action** of a control, if such a **response value** is dependent upon the method of mounting the control in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate household equipment standard or as determined by the manufacturer applies.~~

~~NOTE This part 2-5 includes systems responsive to flame properties.~~

~~1.4 Replacement:~~

~~This part 2-5 applies also to systems incorporating **electronic devices**, requirements for which are contained in Annex H.~~

1.5.1.2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60079-20-1:2010, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

~~IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*~~

ISO 23551-6:2014, *Safety and control devices for gas burners and gas-burning appliances – Part 6: Thermoelectric flame supervision controls*

Replacement:

IEC 60127-1:2015, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

2 Terms and definitions

This clause of Part 1 is applicable except as follows:

2.2 Definitions of types of control according to purpose

NOTE Definition 2.2.23 is not applicable.

Additional definitions:

2.2.101

burner control system

system which includes a **programming unit**, a **flame detector** or, if applicable, an **HTO detector** and may include an **ignition source** and/or **ignition device** and which monitors the **operation** of fuel burners

Note 1 to entry: The various functions of the system may be in one or more housings.

2.2.102

flame detector

device which provides the **programming unit** with a signal indicating the presence or absence of flame

Note 1 to entry: It includes the **flame sensor** and may include an amplifier and a relay for signal **transmission**. The amplifier and relay may be in its own housing or combined with the **programming unit**.

2.2.103

flame sensor

device which senses the flame and provides the input signal to the **flame detector** amplifier

Note 1 to entry: Examples are optical sensors and flame electrodes (flame rods).

2.2.104

ignition source

electrical or electronic system component which provides energy to an **ignition device**

Note 1 to entry: It may be separated from or incorporated in the **programming unit**. Examples are ignition transformers and electronic high-voltage generators.

2.2.105

ignition device

device mounted on or adjacent to a burner for igniting fuel at the burner

Note 1 to entry: Examples are **pilot** burners, spark electrodes and hot surface igniters.

2.2.106

programming unit

device which controls the burner **operation** in a declared sequence from start-up to shut-down within declared timings and in response to signals from regulating, limiting and monitoring devices

2.2.107

multitry system

system that allows more than one **valve open period** during its declared **operating sequence**

2.2.108

HTO detector

device which provides the **programming unit** with a signal indicating presence or absence of **HTO**

Note 1 to entry: It includes the **HTO-sensor** and may include an amplifier and a relay for signal **transmission**. The amplifier and relay may be in its own housing or combined with the **programming unit**.

2.2.109

HTO-sensor

device which senses the temperature of a surface or a medium within the combustion chamber which is in direct contact with a flammable fuel-air mixture and provides a signal indicating presence or absence of **HTO**

2.2.110

auto-ignition temperature

AIT

lowest temperature (of a hot surface or the environment) at which an ignition of a flammable fuel/air mixture occurs

[SOURCE: IEC 60079-20-1:2010,3.3, modified : "or the environment" has been added in the parenthesis, "at which under specified test conditions" has been deleted and " flammable gas or vapour in mixture with air or air/inert gas" has been replaced by " flammable fuel/air mixture"]

2.2.111

high-temperature operation

HTO

operation on the basis of **auto-ignition temperature** which assures ignition and burning of fuel

Note 1 to entry: **High-temperature operation** is used e.g. in fuel cells (IEC 62282-3-100) and in industrial furnaces and associated processing equipment (ISO 13577) where ignition and burning is detected by means of sensing the temperature.

2.3 Definitions relating to the function of controls

2.3.30

T_{\max}

Replace "switch head" by "burner control system."

2.3.32

safety shut-down

Replacement:

de-energization of the main fuel flow means as the result of the action of a limiter, a cut-out or the detection of an internal **fault** of the system

Note 1 to entry: **Safety shut-down** may include additional actions by the system.

Additional definitions:

2.3.101

automatic recycle

automatic repetition of the start-up procedure, without manual intervention, following loss of the supervised flame and subsequent fuel supply shutoff

2.3.102

controlled shut-down

de-energization of the fuel flow means as a result of the opening of a control loop by a control device such as a **thermostat** leading the system to return to the **start position**

Note 1 to entry: **Controlled shut-down** may include additional actions by the system.

2.3.103

flame detector response time

period of time between the loss of the sensed flame and the signal indicating the absence of flame

2.3.104

flame detector operating characteristics

that function of the **flame detector** which indicates absence or presence of flame as the output signal of the **flame detector** relating to the input signal

Note 1 to entry: Normally the input signal is provided by a **flame sensor**.

2.3.104.1

signal for presence of flame

S_1

minimum signal which indicates the presence of flame when there was previously no flame

2.3.104.2
signal for absence of flame

S₂
maximum signal which indicates the loss of flame

Note 1 to entry: **S₂** is less than **S₁**.

2.3.104.3
maximum flame signal

S_{max}
maximum signal which does not affect the timings or the sequence

2.3.104.4
signal for visible light flame simulation

S₃
minimum signal which indicates the presence of flame during the visible light **flame simulation** test

Note 1 to entry: **S₃** is less than **S₂**.

2.3.105
self-checking flame detector

flame detector which checks for correct **operation** of the **flame detector** and its associated electronic circuitry while the burner is in the **running position**

2.3.106
flame detector self-checking rate

frequency of the self-checking function of the **flame detector** (in number of **operations** per unit of time)

2.3.107
flame failure lock-out time

flame failure response time
period of time between the signal indicating absence of flame and **lock-out**

2.3.108
flame failure re-ignition time
relight time

period of time between the signal indicating absence of flame and the signal to energize the **ignition device**, during which the fuel supply is not shut off

2.3.109
flame signal
output signal of the **flame detector****2.3.110**
flame simulation

condition which occurs when the **flame detector** indicates the presence of flame when in reality no flame is present

2.3.111
ignition time
period of time during which the **ignition device** is energized

2.3.112

lock-out

process in which the system goes into one of the following **lock-out** conditions, following **safety shut-down**

2.3.112.1

non-volatile lock-out

condition such that a restart can only be accomplished by a manual **reset** of the system and by no other cause

2.3.112.2

volatile lock-out

condition such that a restart can be accomplished by either a manual **reset** of the system or by an interruption of the power supply and its subsequent restoration

2.3.113

main flame establishing period

period of time between the signal to energize the main fuel flow means and the signal indicating presence of the main burner flame

2.3.114

pilot flame establishing period

period of time between the signal to energize the **pilot** fuel flow means and the signal indicating presence of the **pilot** flame

2.3.115

post-ignition time

period of the **ignition time** between the signal indicating presence of flame and the signal to de-energize the **ignition device**

2.3.116

pre-ignition time

period of the **ignition time** between the signal to ignite and the signal to energize the fuel flow means

2.3.117

proved igniter

proved igniter system

system in which the fuel flow means is energized only after the availability of sufficient energy to ignite the fuel has been verified

Note 1 to entry: Examples are systems using spark supervision and those using proved hot surface igniters.

2.3.117.1

proved igniter operating value

signal which indicates that the **proved igniter** has the energy to ignite the fuel

2.3.117.2

igniter proving time

period of time between the signal to energize the **proved igniter** and the signal to energize the fuel flow means

2.3.117.3

igniter failure response time

period of time between loss of the supervised **proved igniter** and the signal to de-energize the fuel flow means

2.3.118**purge time**

period during which air is introduced to displace any remaining air/fuel mixtures or products of combustion from the combustion zone and flue ways

Note 1 to entry: No fuel is admitted during this period.

2.3.118.1**post-purge time**

purge time that takes place immediately following the shutting off of the fuel supply

2.3.118.2**pre-purge time**

purge time that takes place between **initiation** of a burner control sequence and the admission of fuel to the burner

2.3.119**re-ignition****relight**

process by which, following loss of the **flame signal**, the **ignition device** will be re-energized without interruption of the fuel flow means

2.3.120**recycle time**

period of time between the signal to de-energize the fuel flow means following the loss of flame and the signal to begin a new start-up procedure

2.3.121**running position**

position denoting that the main burner flame is established and supervised, **or the burner is in HTO and supervised**

2.3.122 Void~~**safety shut-down**~~

~~de-energization of the main fuel flow means as the result of the action of a limiter, a cut-out or the detection of an internal **fault** of the system~~

~~Note 1 to entry: **Safety shut-down** may include additional actions by the system.~~

2.3.123**start position**

position which denotes that the system is not in the **lock-out** condition and has not yet received the **start signal**, but can proceed with the start-up sequence if required

2.3.124**start signal**

signal, for example, from a **thermostat**, which releases the system from its **start position**

2.3.125**start-up lock-out time**

period of time between the signal to energize the fuel flow means and **lock-out**

Note 1 to entry: For systems which control two separate fuel flow means, two different **start-up lock-out times** are possible (first and second **start-up lock-out times**).

2.3.126**waiting time**

period between the **start signal** and the signal to energize the **ignition device**

Note 1 to entry: For burners without fans, natural ventilation of the combustion chamber and the flue passages normally takes place during this time.

2.3.127

valve open period

for **multitry systems**, the period of time between the signal to energize the fuel flow means, and the signal to de-energize the fuel flow means, if proof of the supervised burner flame is not established

Note 1 to entry: In the USA, this period is referred to as the "trial-for-ignition period."

2.3.128

valve sequence period

for **multitry systems**, the sum of all valve opening periods prior to **lock-out**, if proof of the supervised burner flame is not established

2.3.129

system restart

process by which, after a **safety shut-down**, a full start-up procedure is automatically repeated

2.3.130

reset from lock-out function

function that provides **reset** from **lock-out** allowing the system to attempt a restart

Note 1 to entry: The **reset** function may be performed by various electric/electronic (mobile) devices.

2.3.131

common cause failures

failures of different items, resulting from a single event, where these **failures** are not consequences of each other

Note 1 to entry: **Common cause failures** should not be confused with common mode failures.

[SOURCE: IEC 60050-191:1990,191-04-23]

2.3.132

HTO detector response time

period of time between the temperature falling below the defined temperature limit for **HTO** and the signal indicating the absence of **HTO**

2.3.133

HTO detector operating characteristics

that function of the **HTO detector** which indicates absence or presence of **HTO** as the output signal of the **HTO detector** relating to the input signal

Note 1 to entry: Normally the input signal is provided by a **HTO-sensor**.

2.3.134

HTO response time

period of time between the signal indicating absence of **HTO** and proceeding to **safety shut-down** or to switch over to flame supervision

2.3.135

HTO signal

output signal of the **HTO detector**

2.5 Definitions of types of control according to construction

Additional definitions:

2.5.101
system for permanent operation

system which is intended to remain in the **running position** for longer than 24 h without interruption

2.5.102
system for non-permanent operation

system which is intended to remain in the **running position** for less than 24 h

Additional definitions:

2.101 Definitions relating to the type of burner (see 6.101)

2.101.1
continuous ignition

type of ignition which, once placed in **operation**, is intended to remain energized continuously until it is manually interrupted

2.101.2
continuous pilot

pilot which, once placed in **operation**, is intended to remain ignited continuously until it is manually interrupted

2.101.3
direct ignition

type of ignition which is applied directly to the main burner, without the use of a **pilot**

2.101.4
expanding pilot

form of **continuous pilot** where the **pilot** flame is increased or expanded when required to ignite the main burner and reduced either immediately after main burner ignition, or after the main flame is shut off

2.101.5
full rate start

condition in which the main burner ignition and subsequent flame supervision occur at full fuel rate

2.101.6
intermittent ignition

type of ignition which is energized when an appliance is called on to operate and which remains continuously energized during each period of main burner **operation** and where the ignition is de-energized when the main burner operating cycle is completed

2.101.7
intermittent pilot

pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner **operation** and where the **pilot** is automatically extinguished when each main burner operating cycle is completed

2.101.8
interrupted ignition

type of ignition which is energized prior to the admission of fuel to the main burner and which is de-energized when the main flame is established

2.101.9
interrupted pilot

pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished when the main flame is established

2.101.10
low rate start

condition in which main burner ignition occurs at low fuel rate

Note 1 to entry: Once ignition at low fuel rate occurs and the flame is proved, full main burner fuel rate may be admitted.

2.101.11
pilot

flame, smaller than the main flame, which is utilized to ignite the main burner or burners

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable except as follows:

4.1 Conditions of test

4.1.1 Replacement:

Unless otherwise specified, the system and each system component are tested as delivered, having been mounted as declared in Table 1 (7.2 of the previous edition), requirement 31, in the most unfavourable position when there is more than one position.

When a separate system component is submitted, the manufacturer shall provide those other system components which may be necessary to perform the relevant tests.

4.1.7 Not applicable.

4.2 Samples required

4.2.1 Replacement:

Unless otherwise specified, one sample shall be used for the tests of Clauses 5 to 14 inclusive. A different sample(s) shall be used for the tests of Clauses 15 to 17. At the option of the manufacturer, the tests of Clauses 18 to 26 ~~inclusive~~ including the relevant annexes may be conducted on a new sample or on the sample(s) used for the tests of Clauses 5 to 14 inclusive. The tests of Clause 27 shall be conducted on a new sample.

4.3 Instructions for test

4.3.2.1 Modification:

Delete "and those for a.c./d.c. at the more unfavourable supply."

4.3.2.4 Not applicable.

4.3.2.6 Replacement:

For systems marked or declared for more than one rated voltage or rated current, the tests of Clause 17 are made at the rated voltage and associated current (or vice versa) which produces the most unfavourable combination.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows:

6.1 According to nature of supply

6.1.1 Systems for a.c. only

Replace explanatory matter by the following requirement:

Systems intended for use on a.c. only supply shall only be used on a.c. supplies.

6.1.3 Not applicable.

6.3 According to their purpose

Additional subclauses:

- 6.3.101 – burner control system;
- 6.3.102 – flame detector;
- 6.3.103 – programming unit;
- 6.3.104 – ignition device;
- 6.3.105 – electronic high-voltage ignition source;
- 6.3.106 – flame sensor;
- 6.3.107 – HTO detector;
- 6.3.108 – HTO-sensor.

6.4 According to features of automatic action

6.4.1 Not applicable.

6.4.3 Addition:

Burner control systems are classified as having **Type 2 action**.

6.4.3.12 Not applicable.

Additional subclauses:

- 6.4.3.101 – **non-volatile lock-out** (Type 2.V);
- 6.4.3.102 – **volatile lock-out** (Type 2.W);
- 6.4.3.103 – non-permanent **operation** (Type 2.AC);
- 6.4.3.104 – permanent **operation** (Type 2.AD);
- 6.4.3.105 – spark supervision (Type 2.AE);
- 6.4.3.106 – air/pressure flow supervision (Type 2.AF);
- 6.4.3.107 – position-checked external devices (Type 2.AG);
- 6.4.3.108 – visible light **flame simulation** check (Type 2.AH);
- 6.4.3.109 – proved hot surface igniter (Type 2.AI).

6.7 According to ambient temperature limits of the switch head

6.7.1 Modification:

Replace "Control with a **switch head**" by "**System** and **system** components".

6.7.2 Modification:

Replace "Control with a **switch head**" by "**System** and **system** components".

6.10 According to number of cycles of actuation (M) of each manual action

6.10.5 to 6.10.7 Not applicable.

6.11 According to number of automatic cycles (A) of each automatic action

Addition:

NOTE In ~~the countries~~ members countries of CENELEC, the minimum value is 250 000 automatic cycles. In Canada, China, in Japan and the USA, the minimum value is 100 000 cycles.

6.11.4 to 6.11.12 Not applicable.

6.15 According to construction

6.15.3 Not applicable.

6.16 Not applicable.

Additional subclauses:

6.101 According to type of burner

NOTE Classification could be according to burner **operation** (for example, forced draught) and type of fuel (for example, gas). See 2.101.1 to 2.101.11.

6.102 According to type of pilot

6.103 According to type of ignition

6.104 According to starting fuel rate

7 Information

This clause of Part 1 is applicable except as follows:

7.2.6 Replacement:

Except as indicated in 7.4, for integrated systems all information is provided by means of declaration (X). For incorporated systems not declared under requirement 50, the marking required is as indicated in Table 1 (7.2 of the previous edition). For incorporated systems declared under requirement 50, the only marking required is the manufacturer's name or trade mark and the **unique type reference** if other required marking is provided by documentation (D).

NOTE See the explanation of documentation (D) contained in 7.2.1.

7.2.9 Modification:

*Replace "**T_{max}** other than 55 °C" by "**T_{max}** other than 60 °C" in the line for symbol for "Ambient temperature limits of **switch head**".*

Table 1 (7.2 of ~~the previous~~ edition 3) – **Required information and methods of providing information (1 of 2)**

Information	Clause or subclause	Method
<i>Modification:</i>		
<i>Replace the following requirements by:</i>		
4 Nature of supply (a.c. or d.c.)	4.3.2, 6.1	C
6 Purpose of system or system component	4.3.5, 6.3	D
7 The type of load controlled by each circuit ^{7b)}	14, 17.3.1, 6.2, H.27.1.2	D
15 Degree of protection provided by enclosure ^{8c)}	6.5.1, 6.5.2, 11.5	D
17 Which of the terminals are suitable for the connection of external conductors, and if they are suitable for line or neutral conductors, or both	6.6, 7.4.2, 7.4.3	D
22 Temperature limits of the system and system components if T_{\min} is lower than 0 °C, or T_{\max} other than 60 °C	6.7, 14.5, 14.7, 17.3	D
23 Temperature limits of mounting surfaces (T_s)	6.12.2, 14.1, 17.3	D
26 Number of cycles of actuation (M) for each manual action ¹⁰¹⁾	6.10	X
28 Not applicable		
31 Method of mounting the system and each system component ^{5e)}	4.1.1, 11.6	D
34 Details of any limitation of operating time	6.4.3.103, 6.4.3.104, 14, 17	D
37 Not applicable		
38 Not applicable		
40 Additional features of Type 2 actions	6.4.3	D
41 Not applicable		
42 Not applicable		
44 Not applicable		
46 Operating sequence	2.3.13, 11.3.108, 15	D
48 Not applicable		
50 System or system components intended to be delivered exclusively to the equipment manufacturer	7.2.1, 7.2.6	X
<i>Add the following additional requirements:</i>		
101 Maximum flame detector response time (if applicable)	2.3.103, 15	D
102 Minimum flame detector self-checking rate (if applicable)	2.3.106, 11.3.107, 15	D
103 Maximum flame failure lock-out time or Maximum flame failure response time (if applicable)	2.3.107, 15	D
104 Maximum flame-failure re-ignition time (if applicable)	2.3.108, 15	D
105 Maximum ignition time (if applicable)	2.3.111, 15	D
106 Maximum main flame establishing period (if applicable)	2.3.113, 15	D
107 Maximum pilot flame establishing period (if applicable)	2.3.114, 15	D
108 Maximum post-ignition time (if applicable)	2.3.115, 15	D
109 Maximum pre-ignition time (if applicable)	2.3.116, 15	D
110 Void		
111 Minimum post-purge time (if applicable)	2.3.118.1, 15	D
112 Minimum pre-purge time (if applicable)	2.3.118.2, 15	D
113 Minimum recycle time (if applicable)	2.3.120, 15	D
114 Maximum start-up lock-out time (if applicable)	2.3.125, 15	D

Table 1 (7.2 of edition 3) – Required information and methods of providing information (2 of 2)

Information		Clause or subclause	Method
115	Minimum waiting time (if applicable)	2.3.126, 15	D
116	Type of burner	6.101	D
117	Type of pilot	6.102, 2.101.2, 2.101.4, 2.101.7, 2.101.9, 2.101.11	D
118	Type of ignition	2.101.1, 2.101.3, 2.101.6, 2.101.8, 6.103	D
119	See Annex H		
120	Means for protecting setting of timings	11.3.4	X
121	See Annex H		
122	Resistance to vibration	17.1.3, 17.16.103	D
123	S₁ (signal for presence of flame)	2.3.104.1, 15.5, 15.6, 15.7	D
124	S₂ (signal for absence of flame)	2.3.104.2, 15.5, 15.6, 15.7	D
125	S_{max} (maximum flame signal , if applicable) ¹⁰³⁾	2.3.104.3, 15.5, 15.6, 15.7	D
126	Electronic high-voltage ignition spark gap ¹⁰²⁾	13.2.101	D
127	Other system components for use with the submitted components to provide a complete system	2.2.101, 2.2.102, 2.2.104, 2.2.106	D
128	For each valve opening period, the maximum time (if applicable)	2.3.127, 11.3.113, 15.5 p)	D
129	Maximum valve sequence period (if applicable)	2.3.128, 11.3.112, 15.5 q)	D
130	S₃ (signal for visible light flame simulation)	2.3.104.4, 11.3.110	X
131	For proved igniters , the characteristics (energy, current, voltage, resistance, temperature, etc.) which establish that the proved igniter has the energy to ignite the fuel	2.3.117	D
132	Proved igniter operating value (Minimum and/or maximum, as applicable)	2.3.117.1, 15.7, 17.16.108, H.27.1.1.3	D
133	Maximum igniter proving time (If applicable)	2.3.117.2, 15.5	D
134	Maximum igniter failure response time (If applicable)	2.3.117.3, 15.5	D
135	Type of lock-out	2.3.112, 11.3.108	D
136	See Annex H		
137	External overcurrent device (if applicable)	11.3.5.2.1a)	D
138	Maximum short circuit current as declared	11.3.5.2.1b)	D
139	The defined temperature limit for HTO	11.3.114	D
140	HTO detector response time	11.3.114	D

NOTES

Additional notes:

101) For 17.16.105, the number of **manual actions** for **lock-out** re-set is a minimum of 6 000.

102) If a range is declared, the maximum value is used for the test of 13.2.102 and 13.2.103.

103) **S_{max}** shall be declared for those systems in which the **maximum flame signal** affects timings or sequence.

8 Protection against electric shock

This clause of Part 1 is applicable except as follows:

8.1 General requirements

Additional subclause:

8.1.101 High-voltage ignition sources

Provision shall be made for protection against contact with high-voltage **ignition sources** having any of the following characteristics:

- a) for continuous spark ignition (pulses within the mains frequency range):
 - the maximum voltage is higher than 10 kV (peak), and/or
 - the maximum current is higher than 0,7 mA (peak);
- b) for pulse spark ignition: (see Figure 101)
 - the charge of an individual ignition pulse exceeds 100 μC , and
 - the duration (d) is greater than 0,1 s, and
 - the interval (i) between individual ignition pulses is less than 0,25 s.

Either the system manufacturer shall provide a warning that is visible when the high-voltage **ignition source** is mounted as in **normal use**, or the equipment manufacturer shall be advised of the need to provide such protection or a warning.

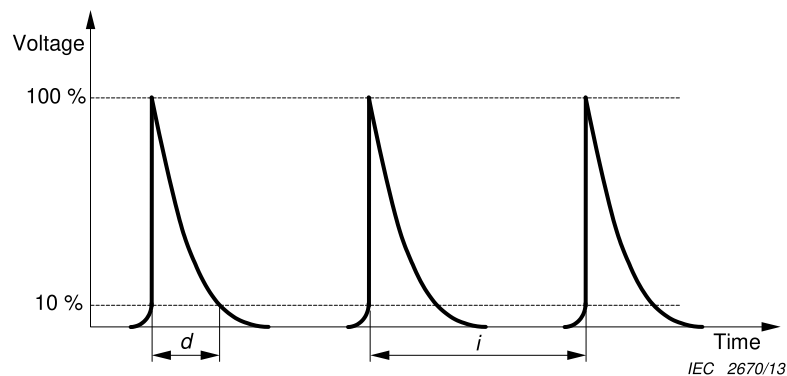


Figure 101 – Pulse spark generation

8.3 Capacitors

Not applicable.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable except as follows:

10.2.4 Flat push-on connectors

Additional subclause:

10.2.4.101 Direct plug-in connections

Systems designed for direct plug-in connection to a sub-base shall be so constructed that they withstand the forces of normal insertion and withdrawal in such a manner that compliance with this ~~part 2-5~~ document is not impaired.

Compliance is checked by performing 10 insertions and withdrawals according to the manufacturer's instructions.

After this test, no significant displacement or damage shall occur.

NOTE The terminals used for direct plug-in connections between the system and/or system components and their sub-bases are not considered flat push-on connectors.

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

~~11.1 Materials~~

~~11.1.2 Not applicable.~~

11.3 Actuation and operation

11.3.4 Setting by the manufacturer

Replacement:

Adjustment means used for the **setting** of timings shall be secured by means providing protection against access by uninstructed persons or shall be declared as requiring such protection in the application.

NOTE For example, such adjustment means can

- 1) be sealed with a material suitable for the temperature range of the system and/or system components such that tampering is apparent, or
- 2) consist of special parts only available from the manufacturer, or
- 3) be accessible only with the use of **special-purpose tools** or access codes.

Compliance is checked by inspection. Where sealing is used, inspection is done before and after the tests of Clause 17.

11.3.5 Contacts – General

~~11.3.5.2 Replacement:~~

~~The system shall include at least two switching elements to directly de-energize the safety relevant valve terminals.~~

Systems of **class C control functions** shall include at least two switching elements to directly de-energize the safety relevant terminals.

NOTE 1 The **burner control system** is a **class C control function**.

NOTE 2 A single relay operating two independent contacts is considered to be only one switching element.

Designs where relays are used as switching elements, a non-replaceable fuse (see Table H.24 Note I) in series with two independent relay contacts with I_N fuse $< 0,6 * I_e$ relay, are considered to comply with the following requirements for prevention of common cause **failure**.

NOTE 3 I_N : values for the fuse (see IEC 60127-1:2015, 3.16);

I_e : rated operational current of the contact (see IEC 60947-1:2007; 4.3.2.3)

In Part 1, the term

- “safety related output terminals” is equivalent to “valve terminals”.
- “safety shut-down” shall be used as defined in this document,
- “control” shall be used as “burner control systems”.

11.3.5.2.1 Measures to protect against common cause failures

Replacement:

~~Designs where relays are used as switching elements, a non-replaceable fuse (see Table H.21 Note 7) in series with two independent relay contacts with I_N fuse $< 0,6 * I_e$ relay, are considered to comply with the following requirements for prevention of common cause failure, without performing the following tests.~~

~~NOTE I_N : values for the fuse (see IEC 60127-1:2006, 3.16);~~

~~I_e : rated operational current of the contact (see IEC 60947-1:2007, 4.3.2.3).~~

~~Measures shall be taken to protect against **failure** of two (or more) switching elements, due to a common cause, by an external short circuit that would prevent the **burner control system** from performing a **safety shut-down**.~~

~~Acceptable methods are~~

- ~~— overcurrent protection device,~~
- ~~— current limitation or~~
- ~~— internal **fault** detecting means.~~

~~The suitability of measures to maintain the capability to interrupt the energization of the shut-off valve terminals by means of at least one switching element or the interruption of a non-replaceable overcurrent protection device shall be verified by the following test.~~

~~The shut-off valve terminals of the **burner control system** are connected to a switch that is intended to switch the short circuit current. With this switch opened, the **burner control system** is connected as described in H.27.1.1.2 with the outputs energized to simulate normal **operation** (contacts of the internal switching elements closed).~~

~~The test equipment shall have the following characteristics:~~

- ~~a) when overcurrent protection device are used as the protective measure, the power supply to the **burner control system** shall have the capability of supplying a short-circuit current of at least 500 A.~~
- ~~b) when current limitation techniques are used as the protective measure (e.g. transformer) the power supply to the **burner control system** shall not limit the declared (Table 1, requirement 138) short-circuit current.~~

~~A short-circuit is applied between the shut-off valve terminals of the **burner control system** by closing the switch.~~

~~The test is terminated if there is no current flow through the switch, or after 1 h.~~

~~If an overcurrent protection device is replaceable and has operated during the test, it shall be replaced and the test is repeated two more times by attempting to restart the **burner control system** keeping the switch closed.~~

~~The test is repeated using either the same or a separate sample with the switch maintained in the closed position prior to the first start-up sequence.~~

~~If an internal **fault** detecting function of the **burner control system** either opens the switching elements or initiates a **safety shut-down** the test is repeated two times by attempting to restart the **burner control system** while maintaining the external short circuit.~~

~~Compliance is checked in accordance with H.27.1.1.3 and Clause 15.~~

~~After the test, at least one switching element of the **burner control system** shall be able to de-energize the shut-off valve terminals, or a non-replaceable overcurrent protection device has permanently interrupted the supply to the shut-off valve terminals.~~

11.3.9 Pull-cord actuated control

Not applicable.

Additional subclauses:

11.3.101 Burner control circuits

Circuits employing **burner control systems** used in earthed supply systems shall be two-wire, one-side nominally earthed. Devices intended to open such a circuit shall be connected to the unearthed side of the supply circuit.

11.3.102 Circuits employing **burner control systems** used in unearthed supply systems shall be two-wire. All devices intended to open such circuits shall be connected to the same side of the supply circuit.

11.3.103 Circuits employing **burner control systems** used in earthed three-phase supply systems shall be four-wire. Devices intended to open such circuits shall be connected to all three phases.

11.3.104 Circuits employing **burner control systems** used in unearthed three-phase supply systems shall be three-wire. Devices intended to open such circuits shall be connected to two or three phases.

11.3.105 If the system initiates a signal to energize the fuel flow means at less than 85 % rated voltage for a.c. and less than 80 % rated voltage for d.c., the system shall comply with the following:

- a) in the **running position**, the system shall proceed to **safety shut-down** or operate with the timings measured at declared ambient temperatures as declared in Table 1 (7.2 of the previous edition), requirements 101 to 104, inclusive;
- b) in any other position, the **operating sequence** shall comply with the declarations of Table 1 (7.2 of the previous edition), requirement 46. The **start-up lock-out time** shall not exceed twice the value declared in Table 1 (7.2 of the previous edition), requirement 114.

Compliance is checked by H.26.5.4.

11.3.106 The system shall provide a safe start check that will cause a), b) or c) to occur if the **failure** results in a flame before the fuel flow means are energized:

- a) the system shall fail to start the **operating sequence**;
- b) the system shall lock out within the time declared in Table 1 (7.2 of the previous edition), requirement 103;
- c) the system shall remain in pre-purge.

NOTE The system can remain in conditions a) or c) until the **fault** clears.

*For systems which incorporate **electronic devices**, compliance is determined by the tests of Clause H.27.*

*For systems not subject to the tests of Clause H.27, a **flame signal** shall be simulated and introduced at the start of the flame establishing period until a), b) or c) occurs.*

11.3.107 Systems declared as Type 2.AD shall perform a self-check at least once every hour, when the system is in the **running position**.

Systems declared in Table 1 (7.2 of the previous edition), requirement 102, have the self-checking rate evaluated as part of the declared sequence and timings. This requirement shall be evaluated in Clauses 15, 17 and H.27.1.2.

11.3.108 Systems shall perform the declared **operating sequence**.

11.3.108.1 The electric circuit of the **actuating means** of the **lock-out** device shall be checked during each start-up sequence.

11.3.108.2 The fuel flow means shall not be energized before the **ignition device**.

11.3.108.3 **Re-ignition** is only permitted when the system is in the **running position**.

11.3.108.4 **Automatic recycle** is only permitted when the system is in the **running position**.

11.3.108.5 If no flame is detected at the end of the first or second **start-up lock-out time** the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

Compliance with 11.3.108 is checked by inspection and by test.

11.3.108.6 If no flame is detected at the end of the **flame failure lock-out time or flame failure response time**, the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

11.3.108.7 After a **safety shut-down** or after a **volatile lock-out reset**, the **operating sequence** may proceed only with a **system restart**.

11.3.109 If the wiring diagram provided by the manufacturer indicates an input to the system from an external limiter or cut-out, then **operation** of this external device shall lead to at least **safety shut-down**.

Compliance is checked by examination of the circuit design.

11.3.110 **Visible light flame simulation test**

Flame detectors classified as Type 2.AH shall have a check to discriminate between **flame simulation** and **flame signals** originating from real flame. Examples of suitable checks are:

- a) prior to the signal to energize the fuel flow means during each start-up sequence, the system shall check for the presence of a **flame signal** that is greater than or equal to **S₃**. If such a signal is detected, the system shall proceed to **lock-out** or shall interrupt the start-up sequence;

for the above test, **S₃** shall be less than **S₂**;

or

- b) after performing a **controlled shut-down**, the system shall check for the presence of a **flame signal** which is less than or equal to **S₂**. If such a signal is detected, the system shall proceed to **lock-out** or shall prevent the next start-up sequence.

11.3.111 For **multitry systems**, the system shall go to **lock-out** at the end of the **valve sequence period**.

11.3.112 For **multitry systems**, further **valve open periods** may be initiated either as a result of loss of supervised flame during the **running position** or **failure** to prove supervised flame during the declared **valve sequence period**.

NOTE **Re-ignition** (see 11.3.108.5) is also allowed if declared.

11.3.113 For **multitry systems**, the **valve open periods** may have different values during the **valve sequence period**.

11.3.114 For **controls** intended for **HTO** using **HTO-sensors**, the temperature shall be monitored. In the event the temperature falls below the defined temperature limit for **HTO**, the **control** shall proceed to **safety shut-down** or switch over to flame supervision (e.g. ionization, UV, IR etc.). This function (including sensor, detector and programming unit) shall be a **class C control function** with **type 2 action**.

The defined temperature limit for **HTO** (see Table 1, requirement 139) shall be the temperature value, which includes the auto-ignition temperature, given in IEC 60079-20-1 or otherwise specified by the product standard, and the tolerances of the signal processing circuit including the sensor.

11.4 Actions

11.4.3 Type 2 action

Replacement:

Any **type 2 action** shall be so designed that the **manufacturing deviation** and **drift** of its **operating value**, **operating time** or **operating sequence** is within the limits declared in Table 1 (~~7.2 of the previous edition~~), requirements 46, 101 to 115 inclusive, and 123 to 125 inclusive, 139 and 140.

11.4.15 Not applicable.

Additional subclauses:

11.4.101 Type 2.V action

A Type 2.V action shall be so designed that a restart can only be accomplished by a manual **reset** of the system.

Systems classified as Type 2.V shall have a **reset** mechanism classified as Type 2.J.

Compliance is checked by inspection and by test.

11.4.102 Type 2.W action

A Type 2.W action shall be so designed that a restart can only be accomplished by either a manual **reset** or an interruption of the power supply and its subsequent restoration.

Compliance is checked by inspection and by test.

11.4.103 For systems with remotely mounted **reset** buttons, a short circuit between the connecting cables or between the connecting cables and earth shall not result in a **reset**.

11.4.104 Systems classified as Type 2.AE shall perform spark supervision prior to energization of the fuel flow means.

11.4.105 Systems classified as Type 2.AF shall check for correct function of external air pressure/flow control.

The system shall perform **safety shut-down** or **lock-out** or shall fail to start if a positive external air pressure/flow control signal is detected prior to start-up.

The system shall perform **safety shut-down** or **lock-out** if insufficient external air pressure/flow is detected during the **purge time** or when the system is in the **running position**.

11.4.106 Systems classified as Type 2.AG which perform position checks during or prior to the start-up sequence shall continue with the **operating sequence** only after these position checks have been successfully performed.

Compliance with 11.4.103 to 11.4.106 inclusive is checked by inspection and by test.

11.4.107 Systems classified as Type 2.AI shall perform hot surface igniter supervision prior to energization of the fuel flow means.

11.10 Equipment inlets and socket-outlets

11.10.2 Not applicable.

11.11 Requirements during mounting, maintenance and servicing

11.11.6 Not applicable.

11.13 Not applicable.

Additional subclauses:

11.101 Flame detector constructional requirements

11.101.1 Flame detector devices using infrared sensors shall only react to the flicker property of the flame.

11.101.2 Flame detector devices using ionization sensors (flame rods) shall only make use of the rectification property of the flame.

11.101.3 Flame detector devices using UV-tubes shall have sufficient checks for ageing of the UV-tubes.

NOTE Examples of suitable checks are

- automatic periodic supervision of the sensor function;
- a check of the UV-tube during the **purge time** with a voltage 15 % higher than that applied to the UV-tube during the remainder of the **operating sequence**;
- a check that the flame relay has dropped out after each **controlled shut-down** with the amplifier continually energized.

11.101.4 An open circuit of the **flame sensor/HTO-sensor** or its connecting cables shall cause loss of the **flame signal/HTO-sensor signal**.

11.101.5 Flame detectors using UV sensors other than UV tubes shall not react to infrared light. Such **flame detectors** shall not indicate a signal for the presence of flame when the sensor is illuminated with 10 lx or less at a colour temperature of 2 856 K with the spectrum being cut off below the wavelength of 400 nm by means of a filter.

11.101.6 Sensors for visible light are not allowed if the illumination intensity is lower than 0,5 lx during **operation**. Systems using sensors for visible light shall not give a detect-of-**flame signal** during **operation** below an illumination intensity of 0,5 lx.

~~Compliance with 11.101.1 to 11.101.6 inclusive is checked by inspection, test and/or measurement.~~

11.101.7 HTO-sensors shall only react to temperature.

NOTE For selecting the position of the **HTO-sensor** in the application, the effect of exposing it to radiant heat directly from the flame is taken into account.

Compliance with 11.101.1 to 11.101.7 inclusive is checked by inspection, test and/or measurement.

11.102 Reset from lock-out function

11.102.1 General

For **automatic controls**, provisions are present to ensure that the appliance can be **reset** from a **lock-out** condition (e. g. caused by overheating of the appliance or no flame establishment).

Traditional methods for resetting heating appliances are:

- conventional mechanical **reset** switch (no or minor simple electronic components present);
- removing the power supply to the control unit (only accepted in case of **volatile lock-out** applications).

New technologies provide more complex **reset** devices, such as:

- a) remote **reset** devices (e.g. through communication lines/protocols);
- b) intelligent complex **reset** devices (e.g. by means of additional hardware and/or software);
- c) infrared or radio frequency controlled **reset** devices;
- d) combinations of a) and b) and c) (e.g. through Internet by means of an interface and a portable telephone).

11.102.2 Performance requirements

The **reset from lock-out function** is a **class B control function** according H.27.1.2.2.

A **reset** action from **lock-out** shall be a **manual action**. An automatic **reset** (e.g. **resets** generated by automatic devices, like **timers**, etc.) shall not be possible unless it is accepted by specific application standards.

The **reset** device shall be capable of resetting the **system** in a proper way. Unintended or spontaneous **resets** from lockout shall not occur.

Whenever the **reset** function is performed by a mobile device, at least two **manual actions** are required to activate a **reset**.

Any **fault** within the **reset** function shall not cause the appliance to operate outside the applicable requirements. It shall be detected before the next start-up or shall not prevent the appliance from going to shut-down or **lock-out**.

For **reset** functions where the **manual action** is initiated without being within the visible sight of the appliance, the following additional requirements apply:

- actual status and relevant information of the process under control shall be visible to the **user** before, during and after the **reset** action;
- maximum number of **resets** shall be limited. Where it is not specified in the specific application standard, the number of **resets** shall be limited to five actions within a time span of 15 min or less. Following this, any further **resets** shall be denied unless the appliance is checked.

If the **reset** is activated by manual switching a **thermostat** or device with a similar function, this shall be declared by the manufacturer for approval with the final appliance.

12 Moisture and dust resistance

This clause of Part 1 is applicable.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable except as follows:

13.1 Insulation resistance

Not applicable.

13.2 Electric strength

Additional subclauses:

13.2.101 The electric strength of the high-voltage side of an electronic high-voltage **ignition source** is not checked by the test of 13.2 to 13.2.4 inclusive, but by the tests of 13.2.102 to 13.2.103, which are conducted immediately after the humidity treatment of 12.2.7 and 12.2.8.

NOTE For electronic high-voltage **ignition sources** which are built into the printed circuit board, additional details of the test methods can be agreed between the manufacturer and the test house.

13.2.102 The input supply terminals of the electronic high-voltage **ignition source** are to be connected to a variable voltage supply at rated input mains frequency. The output voltage is measured at $1,0 V_R$ and $1,1 V_R$ with the spark gap as declared in requirement 126 of Table 1 (7.2 of the previous edition). Then the electronic high-voltage **ignition source** is subjected to the following tests:

- a) all connections to the output terminals are removed. Initially, a voltage not exceeding the rated voltage is applied. Then the input voltage is gradually increased until 150 % of output voltage measured in 13.2.102 (at $1,0 V_R$) is achieved. The output voltage is maintained at that value for 1 min; or

- b) with the input voltage at $1,1 V_R$, the electrode gap is increased from that declared in requirement 126 of Table 1 (7.2 of the previous edition) until either 150 % of the output voltage measured in 13.2.102 (at $1,0 V_R$) is achieved or until the output voltage no longer increases, whichever occurs first. This output voltage is maintained for 1 min; or
- c) if test methods a) and b) cannot be applied, a test method shall be agreed between manufacturer and test authority in order to achieve 150 % of the output voltage measured in 13.2.102 at $1,0 V_R$ or the highest possible output voltage for the device. This output voltage is maintained for 1 min.

13.2.103 *Compliance is determined by measuring the output voltage with $1,1 V_R$ applied to the input terminal and with the spark gap restored to that declared in requirement 126 of Table 1 (7.2 of the previous edition), if applicable. The measured output voltage shall be within ± 10 % of the value measured in 13.2.102 at $1,1 V_R$.*

For 13.2.102 a), b) and c), flashovers which occur at an air gap provided to protect the circuitry are ignored. Glow discharges at the output terminal are neglected.

14 Heating

This clause of Part 1 is applicable except as follows:

14.3 Not applicable.

14.4.2 Not applicable.

14.4.3.1 to 14.4.3.3 Not applicable.

14.4.3.4 *Modification:*

*Replace "other **automatic controls**," by "**systems**".*

14.4.4 Not applicable.

14.5.1 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6.2 Not applicable.

14.7 *Modification:*

*Replace "**switch head**" by "**system**".*

Modification to Table 13 (14.1 of the previous edition):

The section entitled "Accessible surfaces of handles, knobs, grips and the like used for carrying and transporting the control" is not applicable.

15 Manufacturing deviation and drift

This clause of Part 1 is replaced by the following:

15.1 Systems shall have adequate consistency of manufacture with regard to their declared **operating times, operating sequences, flame detector operating characteristics, HTO detector operating characteristics** and **proved igniter operating value**.

15.2 *Compliance is checked by the tests of 15.5, 15.6 ad 15.7.*

15.3 The appropriate **operating time, operating sequence, flame detector operating characteristics, HTO detector operating characteristics** and **proved igniter operating value** shall be recorded for the sample.

15.4 Three tests shall be conducted for each **operating time, each operating sequence, flame detector operating characteristics, HTO detector operating characteristics** and each **proved igniter operating value** declared.

15.5 Operating times

Each of the following **operating times** which are declared applicable in Table 1 (7.2 of the previous edition) shall be measured at a voltage of $0,85 V_R$ a.c. or $0,80 V_R$ for d.c. and at a temperature of T_{min} .

Measurements shall also be taken at a voltage of $1,1 V_R$ and a temperature of T_{max} .

None of the times recorded shall exceed the manufacturer's declared maximum times nor be less than the manufacturer's declared minimum times, whichever is applicable.

- a) **flame detector response time;**
- b) **flame detector self-checking rate;**
- c) **flame failure lock-out time or flame failure response time;**
- d) **flame failure re-ignition time (relight time);**
- e) **ignition time;**
- f) **main flame establishing period;**
- g) **pilot flame establishing period;**
- h) **post-ignition time;**
- i) **pre-ignition time;**
- j) Void;
- k) **post-purge time;**
- l) **pre-purge time;**
- m) **recycle time;**
- n) **start-up lock-out time;**
- o) **waiting time;**
- p) valve opening period;
- q) **valve sequence period;**
- r) **igniter proving time;**
- s) **igniter failure response time**
- t) **HTO detector response time.**

NOTE For test purposes, the **flame detector operating characteristics** (S_1 and/or S_2 and/or S_{max}) can be artificially simulated.

15.5.4 Not applicable.

15.6 Operating sequence

The **operating sequence** shall be tested at a voltage of $0,85 V_R$ a.c. or $0,80 V_R$ for d.c. and at a temperature of T_{min} . A test shall also be conducted at a voltage of $1,1 V_R$ and a temperature of T_{max} .

The **operating sequence** shall be as declared.

NOTE For test purposes, the **flame detector operating characteristics** (S_1 and/or S_2 and/or S_{max}) can be artificially simulated.

15.7 Flame detector operating characteristics, HTO detector operating characteristics and proved igniter operating value

The operating characteristics of **flame detectors**, **HTO detector** and **proved igniter operating value** shall be measured under the following conditions:

- a) at V_R and $(20 \pm 5) ^\circ\text{C}$;
- b) at $0,85 V_R$ and $0 ^\circ\text{C}$ or T_{min} , whichever is lower, and
- c) at $1,1 V_R$ and $60 ^\circ\text{C}$ or T_{max} , whichever is higher.

The measured values shall be as declared in Table 1 ~~(7.2 of the previous edition)~~ requirements 123, 124, 125, 132 and 139 as applicable.

The details of the measuring equipment shall be arranged between the manufacturer and the test house.

If a lamp is used for response to the visible range of light, it shall have a colour temperature of 2 856 K.

NOTE The preceding paragraph is not applicable in the USA and Canada.

16 Environmental stress

This clause of Part 1 is applicable, except as follows:

16.2.4 Replacement:

In addition, the appropriate tests of Clause 15 shall be repeated, only at room temperature, after each of the above tests. The values in these tests shall not differ from the values declared in Table 1 (7.2 of the previous edition).

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.1 General requirements

Replacement:

17.1.1 Systems including those submitted in or with an appliance shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses that occur in **normal use**.

17.1.2 *Compliance is checked by the tests indicated in 17.1.3.*

17.1.3 Test sequence and conditions

In general, the sequence of tests is:

- *for electronic **systems**, the thermal cycling test specified in 17.16.101;*
- *endurance test of automatic and **manual action** at normal operating rate specified in 17.16.102;*
- *vibration test of 17.16.103, if declared;*
- *endurance test of **automatic action** at accelerated rate specified in 17.16.104.*

NOTE For test conditions, see 17.2 and the relevant tests of 17.16.

*The number of **operations** performed during 17.16.101, 17.16.102 and 17.16.104 is recorded. When the actual number of automatic cycles completed is equal to the number declared in Table 1 (7.2 of the previous edition) requirement 27, this test sequence is concluded and the following sequence is performed:*

- ***lock-out reset** test of 17.16.105;*
- *endurance test of 17.16.106.1, if applicable;*
- *electrical strength requirements specified in 17.16.107;*
- *evaluation of compliance specified in 17.16.108.*

Whenever possible the tests of 17.16.101 to 17.16.105 may be combined.

17.3 (except 17.3.1) to **17.15** Not applicable.

17.16 Tests for particular purpose systems

Additional subclauses:

17.16.101 Thermal cycling test for electronic systems

*The purpose of the test is to cycle components of an electronic circuit between the extremes of temperature likely to occur during **normal use** and which may result from ambient temperature variation, mounting surface temperature variation, supply voltage variation or the change from an operating condition to a non-operating condition and vice versa.*

The following conditions shall form the basis of the test.

- a) *Duration of test: 14 days*
- b) *Electrical conditions*

*The **system** is loaded according to the ratings declared by the manufacturer, the voltage then being increased to 1,1 V_R except that for 30 min during each 24 h period of the test the voltage is reduced to 0,9 V_R . The change of voltage shall not be synchronized with the change of temperature. Each 24 h period shall also include at least one period in the order of 30 s during which the supply voltage is switched off.*

- c) *Thermal conditions*

The ambient temperature and/or the mounting surface temperature are varied between T_{max} and T_{min} to cause the temperature of the components of the electronic circuit to be cycled between their resulting extremes. The rate of ambient and/or mounting surface

temperature change shall be in the order of 1 °C/min and the extremes of temperature maintained for approximately 1 h. Care shall be taken to avoid the occurrence of condensation during this test.

d) **Rate of operation**

During the test, the **system** shall be cycled through its operational modes at the fastest rate possible up to a maximum of six cycles/min subject to the need to cycle components of the electronic circuit between their temperature extremes.

17.16.102 Endurance test of automatic and manual action at normal operating rate

17.16.102.1 Test sequence and conditions

The test is carried out with the terminals loaded with the maximum current and the minimum power factor declared by the manufacturer.

The **system** and its **flame detector** and/or **HTO detector** are tested under the following conditions:

a) 45 000 **operations** at V_R and (20 ± 5) °C;

NOTE In the USA and Canada, if the **system** is electro-mechanical, this test is performed at T_{max} .

b) 2 500 **operations** at T_{max} and 1,1 V_R or 1,1 times the upper limit of the rated voltage range;

c) 2 500 **operations** at T_{min} and 0,85 V_R or 0,85 times the lower limit of the rated voltage range for a.c. and 0,80 V_R or 0,80 times the lower limit of the rated voltage range for d.c.

The **HTO** function, if applicable shall be included in the sequence.

17.16.103 Vibration test

Systems declared in Table 1 (7.2 of the previous edition), requirement 122 are subjected to the vibration test of IEC 60068-2-6 as follows:

Cycling rate:	as declared
Loaded at:	1,1 V_R
Frequency range:	10 Hz to 150 Hz
Acceleration amplitude:	1 g or higher if declared by the manufacturer
Sweep rate:	1 octave/min
No. of sweep cycles:	10
No. of axes:	3, mutually perpendicular

17.16.104 Endurance test of automatic action at accelerated rate

This test shall be conducted at V_R , I_R and T_{max} .

The following means may be used to accelerate the test time of the **systems**:

- substitution of the components of the electronic circuit previously found acceptable under the abnormal **operation** test of Clause H.27;
- modification of control circuits to eliminate the portions of control programming that do not affect the **operating time** of the **system** or **system** component being tested;
- applying additional heating or external cooling to the thermal **timers** in the manner that does not alter the normal operating characteristics of the **timer** other than its timing.

NOTE The electromechanical components can be tested separately under the operating conditions to which they are subjected when incorporated into the **system** circuit, including the electrical loading of the contacts.

An additional sample may be required for this test.

17.16.105 Lock-out reset test

The **system** is also tested under the following **lock-out** conditions, mounted as declared in Table 1 (7.2 of the previous edition), requirement 31:

- the first half of the declared cycles (see requirement 26 and note 101 to Table 1 (7.2 of the previous edition)), without flame presence;
- the second half of the declared cycles, the flame disappearing during **operation**.

During the tests described above, the **system** is operated in such a way that the normal start-up sequence is performed.

The repetitions of the sequence shall be compatible with the method of **operation** of the **system** and shall be dependent on the cycling rate, if any, declared by the manufacturer.

17.16.106 Components of systems which are declared for operation in an ambient temperature above 125 °C

17.16.106.1 Endurance test

For **system** components which are declared in Table 1 (7.2 of the previous edition) requirement 22, for **operation** in an ambient temperature above 125 °C, but not subjected to this temperature during the tests of 17.16.101 to 17.16.104, the **system** components are mounted as declared in Table 1 (7.2 of the previous edition), requirement 31. The **system** components are placed in a test chamber and cycled for the declared number of cycles.

During the "ON" cycle, the temperature of the **system** components is raised to within + 5 % of the maximum operating temperature declared by the manufacturer.

During the "OFF" cycle, the test chamber heat source is interrupted and the **system** components cooled naturally or by passing room temperature air over the components as specified by the manufacturer, until the temperature is reduced to 125 °C or less as necessary to permit the **system** to complete the current cycle.

17.16.107 Electric strength requirements

After all the tests of 17.16.101 to 17.16.107 inclusive, the requirements of 13.2 shall apply, with the exception that the samples are not subjected to the humidity treatment before the application of the test voltage.

17.16.108 Evaluation of compliance

After completion of all applicable tests of 17.16.101 to 17.16.107 inclusive, the sample shall be retested according to Clause 15. The **operating times, operating sequence, flame detector operating characteristics, HTO detector operating characteristics** and **proved igniter operating value** shall be as declared in Table 1 ~~(7.2 of the previous edition)~~.

For **systems** providing **electronic disconnection** (Type 1.Y or 2.Y), the requirements of H.11.4.16 are still met.

18 Mechanical strength

This clause of Part 1 is applicable except as follows:

18.2 Impact resistance

18.2.4.1 Not applicable.

18.5 to 18.8 Not applicable.

19 Threaded parts and connections

This clause of Part 1 is applicable.

20 Creepage distances, clearances and distances through solid insulation

This clause of Part 1 is applicable except as follows:

Addition:

For the high-voltage side of electronic high-voltage **ignition sources**, the requirements of Clause 20 are not applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – Emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

This clause of Part 1 is applicable.

26 Electromagnetic compatibility (EMC) requirements – Immunity

See Annex H.

27 Abnormal operation

This clause of Part 1 is applicable except as follows:

27.3 Over-voltage and under-voltage test

Not applicable.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is applicable.

Figures

The figures of Part 1 are applicable

Annexes

The annexes of Part 1 are applicable except as follows:

Annex H (normative)

Requirements for electronic controls

H.6 Classification

This clause of Part 1 is applicable except as follows:

H.6.18.2

Addition:

The **reset** from **lock-out** function as specified in 11.102 is a **class B control function**.

H.6.18.3

Addition:

Burner control systems as specified in 11.3.101 to 11.3.113 inclusive are **class C control functions**.

H.7 Information

This clause of Part 1 is applicable except as follows:

Table H.1 (7.2 of the previous edition)

Modification:

Information		Clause or subclause	Method
52	Not applicable		
58a	Not applicable		
58b	Not applicable		
60	Not applicable		
<i>Modify the existing requirement:</i>			
71	Not applicable		
<i>Add the following additional requirement:</i>			
119	Defined state "out of operation"	H.26.8.2	X
<i>Add the following additional requirement:</i>			
121	The effect on solid-state outputs for motors, transformers, valves, etc. as a result of the tests of Clause H.26	H.26.2	X
<i>Add the following additional requirement:</i>			
136	Software fault/error detection time(s) for controls of software class C ^{12), 104)}	H.27.1.2.3	X
NOTES:			
<i>Additional notes:</i>			
¹⁰⁴⁾	The fault/error detection time is the period between the execution (after the fault has occurred), of the relevant software segment, either for function or for checking purposes and the completion of the declared control response.		

H.17 Endurance

This clause of Part 1 is not applicable.

See 17.16.101.

H.26 Electromagnetic compatibility (EMC) requirements – Immunity

This clause of Part 1 is applicable except as follows:

H.26.1 *Modification:*

The third paragraph is not applicable.

H.26.2 *Replacement:*

Compliance is checked according to the criteria described in each of the Subclauses H.26.54 to H.26.12 inclusive.

H.26.4 **Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests**

Addition:

The test shall be performed

- a) during stand-by time;
- b) during start-up period;
- d) in the **running position**;
- e) in the **lock-out** position.

The system shall tolerate harmonics and interharmonics including mains signalling at a.c. power port, so that, when tested in accordance with H.26.4, either it shall continue to function in accordance with the requirements of this document or it may proceed to **safety shut-down**, which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.5 Voltage dips, voltage interruptions and voltage variations in the power supply network

H.26.5.1.2 Test procedure for voltage dips and interruptions

Addition:

The test shall be performed three times in each of the following operating modes:

- a) during pre-purge or **waiting time**;
- b) during **start-up lock-out time(s)**;
- c) in the **running position**;
- d) in the **lock-out** position.

Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.

The system shall tolerate voltage dips and short interruptions in the electricity supply in accordance with the requirements of Table H.14.

Compliance shall be as follows:

- 1) Duration of half and one cycle of the supply waveform: it shall continue to function in accordance with the requirements of this document. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- 2) Duration of 2,5, 25 and 50 cycles: either it shall perform as in a) or it may proceed to **safety shut-down** followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

When the power supply is restored, the **system restart** shall comply with the requirements for a start-up sequence.

Requirement 2) can be ignored, provided that the power **failure** is less than 60 s and occurs within 60 s after call for heat. On restoration of the power, the programme may be continued from the point at which it was interrupted.

A shortened start-up sequence, for example, a start-up sequence without pre-purge or **waiting time**, is allowed, provided that the power **failure** occurs within 60 s after the end of the start-up sequence and is shorter than 60 s.

H.26.5.2 Voltage variation test values

Replacement:

The **system** shall tolerate voltage dips, short interruptions and voltage variations in the electricity supply so that, when tested in accordance with H.26.5.3,

- a) for assessment a): it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- b) for assessment b): either it shall perform as in a) or it may proceed to **safety shut-down** followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.

NOTE ~~Non-volatile lock-out~~ excludes the use of ~~system restart~~.

When the power supply is restored, the ~~system restart~~ shall comply with the requirements for a start-up sequence.

Requirement b) can be ignored, provided that the power **failure** is less than 60 s and occurs within 60 s after call for heat. On restoration of the power, the programme may be continued from the point at which it was interrupted.

A shortened start-up sequence, for example, a start-up sequence without pre-purge or **waiting time**, is allowed, provided that the power **failure** occurs within 60 s after the end of the start-up sequence and is shorter than 60 s.

Table H.101 — Voltage dips, short interruptions and voltage variations

Assessment criteria	Duration	ΔU		
		30 %	60 %	100 %
a)	Half-cycle of supply waveform			X
	One cycle of supply waveform			X
b)	2,5 cycles	X	X	X
	25 cycles	X	X	X
	50 cycles	X	X	X

The test shall be performed in accordance with H.26.5.3.

H.26.5.2.1 Test levels for voltage variations

The duration and test values in Table H.101 shall be applied.

H.26.5.2.2 Test procedure

Replacement:

The control shall operate according to the functional specification (see 11.3.105) at least within the voltage tolerance band of the rated voltage $\begin{matrix} +10 \\ -15 \end{matrix}$ %, and below – 15 % of the rated voltage the control shall stay safe.

The test apparatus and procedures shall be as described in IEC 61000-4-11. The duration of the voltage changes and the time for which the reduced voltages are to be maintained are given in Table H.101 and illustrated in Figure H.101. The rate of change of voltage shall be constant; however, the voltage is allowed to be stepped. The steps shall be positioned at zero

crossing and shall be not larger than 10 % of V_R . Steps under 1 % of V_R are evaluated as constant rate of change of voltage.

The control, in the **running position**, is supplied at rated voltage, or at the lowest rated voltage of a rated voltage range. After approximately 1 min, the power supply voltage is reduced to a level such that the control ceases to respond to safety related inputs and/or drive safety related outputs (e.g. **flame signal**, fuel valve).

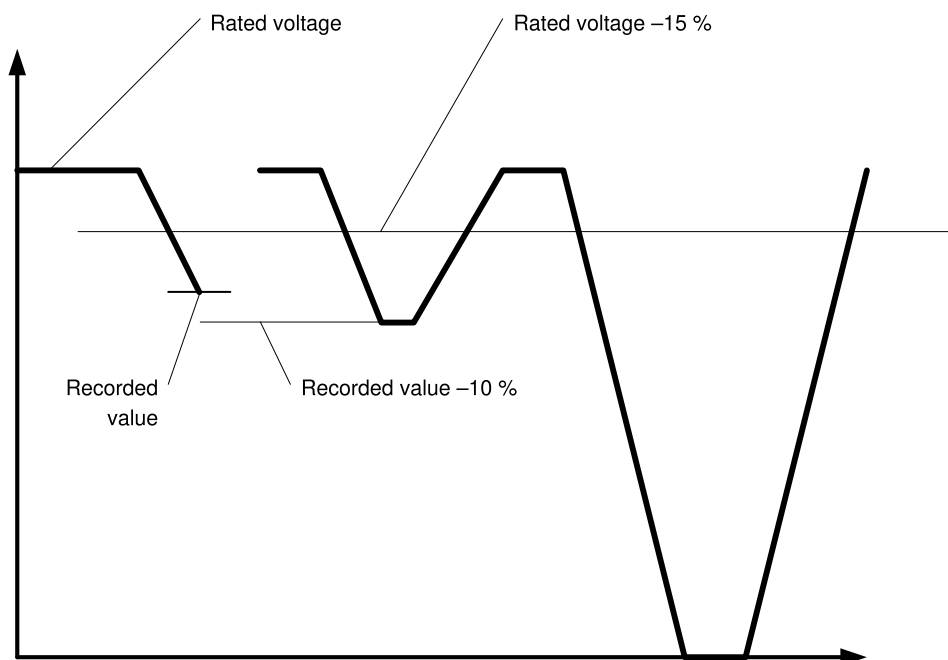
This value of the supply voltage is recorded.

Table H.101 – Timing of short-term supply voltage variations

Voltage test level	Time for decreasing voltage	Time at reduced voltage	Time for increasing voltage
Recorded value – 10 %	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %
0 V	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %

In the voltage range of **operation**, from rated voltage to 1,05 times of the recorded value, the control shall conform to 11.3.105 a). In the voltage range of **operation**, between 85 % of the rated voltage and 1,05 times of the recorded value, the control shall conform to 11.3.105 b).

For test purposes, precautions shall be taken to ensure that signals, e.g. from sensors or switches that can initiate a safety action and the presence of which normally may be independent of the supply voltage, are present at any level of the supply voltage. The signal may be simulated to prevent the **control** de-energizing the safety relevant output(s) as a result of disappearance of such input signals.



IEC

Figure H.101 – Voltage variation test

Each of the above tests is repeated three times in each of the following operating modes:

- a) during pre-purge or **waiting time**;

- b) during **start-up lock-out time(s)**;
- c) in the **running position**;
- d) in the **lock-out** position.

Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.

After the tests, the system:

- 1) shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**, or
- 2) shall either perform as in 1) or it may proceed to **safety shut-down** followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE Non-volatile lock-out excludes the use of system restart.

H.26.5.3 Test procedure

Replacement:

~~The **system** is tested in accordance with IEC 61000-4-11.~~

~~The supply voltage to the **system** shall be reduced according to the values shown in Table H.101. The voltage dips, short interruptions and voltage variations shall be performed at random phase with respect to mains frequency three times in each of the following operating conditions:~~

- ~~a) during pre-purge or **waiting time**;~~
- ~~b) during **start-up lock-out time(s)**;~~
- ~~c) in the **running position**;~~
- ~~d) in the **lock-out** position.~~

~~Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.~~

H.26.5.4.1 Purpose of the test

Replacement:

~~The purpose of the test is to verify the immunity of the control against voltage change taking place over a short period which may occur due to a change of load or stored energy in local power networks. The control shall operate according to the functional specification (see 11.3.105) at least within the voltage tolerance band of the rated voltage $\frac{+10}{-15}$ %, and below -15 % of the rated voltage, the control shall stay safe.~~

H.26.5.4.2 The duration and procedure

Replacement:

~~The duration of the voltage changes and the time for which the reduced voltages are to be maintained are given in Table H.13 (Table H.26.5.4.2 of the previous edition) and illustrated in Figure H.2 (Figure H.26.5.4.2 of the previous edition). The rate of change of voltage shall be constant; however, the voltage is allowed to be stepped. The steps shall be positioned at zero crossing and shall be not larger than 10 % of V_R . Steps under 1 % of V_R are evaluated as constant rate of change of voltage.~~

The control, in the **running position**, is supplied at rated voltage, or at the lowest rated voltage of a rated voltage range. After approximately 1 min, the power supply voltage is reduced to a level such that the control ceases to respond to safety related inputs and/or drive safety related outputs (e.g. **flame signal**, fuel valve).

This value of the supply voltage is recorded.

Table H.13 (Table H.26.5.4.2 of the previous edition) —
Timing of short-term supply voltage variations

Voltage test level	Time for decreasing voltage	Time at reduced voltage	Time for increasing voltage
Recorded value - 10 %	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %
0 V	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %

In the voltage range of **operation**, from rated voltage to 1,05 times of the recorded value, the control shall conform to 11.3.105 a). In the voltage range of **operation**, between 85 % of the rated voltage and 1,05 times of the recorded value, the control shall conform to 11.3.105 b).

For test purposes, precautions shall be taken to ensure that signals e.g. from sensors or switches that can initiate a safety action and the presence of which normally may be independent of the supply voltage, are present at any level of the supply voltage. The signal may be simulated to prevent the control de-energizing the safety relevant output(s) as a result of disappearance of such input signals.

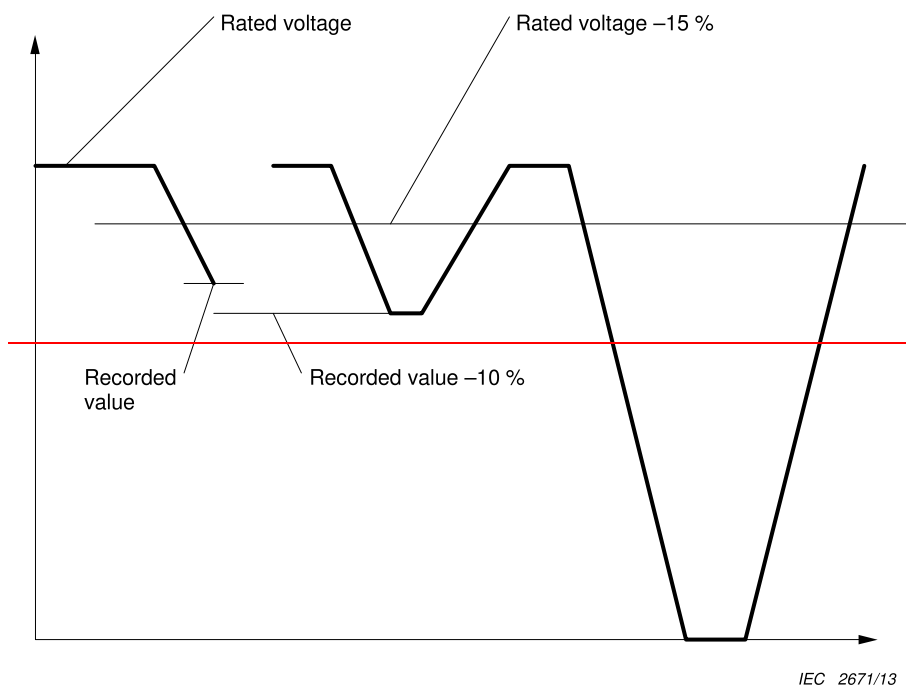


Figure H.2 (H.26.5.4.2 of the previous version) — **Voltage variation test**

H.26.5.4.3 — *Addition:*

Each of the above tests is repeated three times in each of the operating conditions indicated in H.26.5.3.

After the tests, the **system:**

- ~~a) shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**, or~~
~~b) shall either perform as in a) or it may proceed to **safety shut-down** followed by a **system restart**, or if in **volatile lock-out**, it may proceed to a **system restart**.~~

~~NOTE—**Non-volatile lock-out** excludes the use of **system restart**.~~

H.26.6 Test of influence of voltage unbalance

Not applicable.

H.26.8 Surge immunity test

~~H.26.8.2 Test values~~

~~Addition:~~

~~The **system** shall tolerate voltage surges on the mains supply and relevant signal terminals, so that, when tested in accordance with H.26.8.3,~~

- ~~a) for the values of Table H.14 (Table H.26.8.2 of the previous edition) installation class 2, it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out** nor shall it **reset** from **lock-out**;~~
~~b) for the values of Table H.14 installation class 3 for all listed tests, either it shall perform as in a) or it may proceed to **safety shut-down**, which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE—**Non-volatile lock-out** excludes the use of **system restart**.~~

- ~~c) for the values of Table H.14 installation class 4 with line to earth on power supply only, either it shall perform as in a) or b) or it shall go into the defined state “out of **operation**” as declared by the manufacturer in accordance with Table 1 (7.2 of the previous edition) requirement 119.~~

~~For compliance criteria a) and b), after the tests as detailed in Table H.14 (H.26.8.2 of the previous edition), the surge protective components shall not be destroyed.~~

H.26.8.3 Test procedure

Replacement of the second paragraph:

The test shall be carried out by subjecting the system to five pulses and with the voltage and current values listed in Table H.14 at intervals of not less than 60 s.

*The five pulses of each polarity (+, –) and each phase angle as described in IEC 61000-4-5 are delivered in the following **order operating modes**:*

- a) 2 pulses with the system in the **lock-out** position;*
- b) 1 pulse with the system in the **running position**;*
- c) 2 pulses randomly applied during the start-up sequence.*

~~The tests on interface cables are not carried out if the manufacturer explicitly specifies that the length of that cable shall not exceed 10 m.~~

~~If “VDR” are used as surge protective devices, they shall comply with IEC 61643-11. Additionally, they shall be selected to withstand the impulses corresponding to the installation class level.~~

~~For controls having surge protective device arresters incorporating spark gaps, the test is repeated at a level that is 95 % of the flashover voltage.~~

The system shall tolerate voltage surges on the mains supply and relevant signal terminals, so that, when tested in accordance with H.26.8.3,

- 1) for the values of Table H.16 installation class 2, it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out** nor shall it **reset** from **lock-out**;
- 2) for the values of Table H.16 installation class 3 for all listed tests, either it shall perform as in 1) or it may proceed to **safety shut-down**, which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

- 3) for the values of Table H.16 installation class 4 with line to earth on power supply only, either it shall perform as in 1) or 2) or it shall go into the defined state “out of **operation**” as declared by the manufacturer in accordance with Table 1, requirement 119.

For compliance criteria 1) and 2), after the tests of H.26.8.3, the surge protective components shall not be destroyed.

H.26.9 Electrical fast transient/burst test

~~H.26.9.2 Test levels~~

~~Replacement of "Table H.15" by "Table H.102" in the first paragraph.~~

~~Replacement of Table H.15 by Table H.102.~~

Table H.102 — Test level for electrical fast transient burst

Assessment criteria	Severity level in accordance with IEC 61000-4-4	L1, L2, PE		I/O	
		Voltage peak	Repetition rate	Voltage peak	Repetition rate
		kV	KHz	kV	kHz
a)	2	1	5	0,5	5
b)	3	2	5	1	5
e)	4	4	5	-	-

H.26.9.3 Test procedure

~~Replacement:~~

~~The **system** shall tolerate electrical fast/transient bursts on the mains supply and signal lines, so that, when tested in accordance with H.26.9.2,~~

- a) ~~for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;~~
- b) ~~for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out**, it may proceed to a **system restart**;~~

NOTE ~~**Non-volatile lock-out** excludes the use of **system restart**.~~

~~e) for assessment criteria c), either it shall perform as in a) or b) or it shall be set out of **operation** into a defined state as declared by the manufacturer in accordance with Table 1 (7.2 of the previous edition) requirement 119.~~

~~The test shall be performed for 20 cycles with the **system** having reached the **running position**, remaining in the **running position** for a minimum of 30 s within each cycle. The test shall also be performed for a minimum of 2 min with the **system** in the **lock-out** position and with the **system** in the stand-by position.~~

Modification:

Replace the 2nd paragraph of Part 1 by the following:

*The test shall be performed for 20 cycles with the system having reached the **running position**, remaining in the **running position** for a minimum of 30 s within each cycle. The test shall also be performed for a minimum of 2 min with the system in the **lock-out** position and with the system in the stand-by position.*

The system shall tolerate electrical fast transient bursts on the mains supply and signal lines, so that, when tested in accordance with H.26.9.2,

- a) for test level 2 of Table H.17: it shall continue to function in accordance with the requirements of this document. It shall neither go to **safety shut-down** or **lock-out**, not shall it **reset** from **lock-out**;*
- b) for test level 3 of Table H.17: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**;*

NOTE Non-volatile lock-out excludes the use of system restart.

*c) for test level 4 of Table H.17, either it shall perform as in a) or b) or it shall be set out of **operation** into a defined state as declared by the manufacturer in accordance with Table 1, requirement 119.*

H.26.10 Ring wave test

H.26.10.4 Severity Test levels

Replacement:

Burner control systems are to be tested at two of the severity levels of the peak values of open-circuit voltage and short-circuit current of the surges, in accordance with Table H.103~~18~~.

Table H.103 – Peak voltages

Maximum rated input voltage V	Severity ^{a b}					
	Severity level I		Severity level II		Severity level III	
	kV	R1	kV	R1	kV	R1
100	0,5	25	0,8	25	1,5	2,5
300	1,0	25	1,6	25	2,5	2,5
600	2,0	25	3,0	25	5,0	2,5
^a kV open-circuit – See Figure H.4 for R1						
^b See Annex L for categories.						

H.26.10.5 Test procedure

Additional subclauses:

H.26.10.5.101.4 ~~Systems~~ other than those operating at **SELV** are tested according to severity level II and severity level III respectively.

H.26.10.5.101.2 ~~102~~ **SELV systems** are tested according to severity level I and severity level II respectively.

H.26.10.5.101.3 ~~103~~ Each control is to be subjected to five impulses of each polarity, positive and negative (+ , -) and with phase relationships of at least 0°, 90°, 180°, and 270°, applied in turn between the power supply terminals of the control and between each of the load terminals, at intervals not less than 60 s.

H.26.10.5.101.4 ~~104~~ For these tests, the control is to be energized at rated voltage. Approximately half of the tests are to be conducted with the control in the **lock-out** condition and the other half during other **operating sequences** which are considered to be most likely affected by the voltage or current surges.

H.26.10.5.101.5 ~~105~~ After each of the severity level I tests for **SELV systems** and severity level II for **systems** other than **SELV**, the controls shall operate in accordance with item a) of H.26.10.5.101.6. After each of the severity level II tests for **SELV systems** and severity level III tests for **systems** other than **SELV**, the controls shall operate in accordance with any one of the criteria specified in H.26.10.5.101.6 ~~106~~.

H.26.10.5.101.6 ~~106~~ After each test, the control shall operate in accordance with either of the following:

- a) The control continues to operate in its normal **operating sequence** and declared timings.
- b) The control operates to de-energize the fuel flow means or both the fuel flow means and the **ignition source**.
- c) The control completes the current operating cycle with either the fuel flow means or both the fuel flow means and the **ignition source** de-energized and fails to start the subsequent cycle.
- d) The control completes the current cycle with either the fuel flow means or both the fuel flow means and the **ignition source** de-energized and initiates a new start-up procedure and thereafter operates in its normal **operating sequence** and declared timings.
- e) For the disturbances applied during the normal running condition with the flame being proved, the control may initiate a **re-ignition** procedure, if designed to do so, and thereafter operates in its normal **operating sequence** and declared timings.
- f) The control goes into **safety shut-down** condition.

H.26.11 Electrostatic discharge test

Additional subclauses:

~~H.26.11.101—Test and operating conditions~~

~~This test is carried out in accordance with IEC 61000-4-2.~~

H.26.11.102101 Test conditions

Table H.104103 – Test levels for electrostatic discharge

Assessment criteria	Severity level	Contact discharge	Air discharge
a)	2	4 kV	4 kV
b)	4	8 kV	15 kV

The **system** has to be tested in each of the following conditions:

- **start position**;
- **running position**;
- **lock-out position**.

The system shall tolerate electrostatic discharges so that, when tested,

- a) for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;*
- b) for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.*

NOTE 1 **Non-volatile lock-out** excludes the use of **system restart**.

NOTE 2 In Canada and the USA, accessible parts can include parts which can be contacted during installation and service.

~~H.26.11.103 Operating conditions/compliance~~

~~The **system** shall tolerate electrostatic discharges so that, when tested in accordance with H.26.11,~~

- ~~a) for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;~~
- ~~b) for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE 1 **Non-volatile lock-out** excludes the use of **system restart**.~~

~~NOTE 2 In Canada and the USA, accessible parts can include parts which can be contacted during installation and service.~~

H.26.12 Radio-frequency electromagnetic field immunity

H.26.12.2.1 Test levels for conducted disturbances

~~Replacement:~~

Table H.105 — Test levels for conducted disturbances on mains and I/O lines

		Frequency range 150 kHz to 80 MHz	
Assessment criteria	Severity level	Voltage level (e.m.f) U_0 V	
		150 kHz to 80 MHz	ISM and CB bands
a)	2	3	6
b)	3	10	20

The levels in the ISM, CB bands are chosen to be 6 dB higher.
 ISM: ~~Industrial, scientific and medical radio frequency equipment 13,56 ± 0,007 MHz, 40,68 ± 0,02 MHz.~~
 CB: ~~Citizen band: 27,125 ± 1,5 MHz.~~

The tests on interface cables are not carried out if the manufacturer explicitly specifies that the length of that cable shall not exceed 1 m.

H.26.12.2.2 Test procedure

Addition:

The **system** shall be swept through the complete frequency range at least once with the **system** in each of the following ~~positions~~ **operating modes**:

- **start position**;
- **running position**;
- **lock-out position**.

The **system** is subjected to two sweeps of the frequency range from minimum to maximum at the indicated severity level. One sweep is performed with the **system** in the **lock-out** condition. The other sweep is performed during the remainder of the **operating sequence**.

~~Additional subclause:~~

~~The system shall tolerate conducted electromagnetic fields so that, when tested,~~

- ~~for test level 2 of Table H.19: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;~~
- ~~for test level 3 of Table H.19: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.~~

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

~~H.26.12.2.101 — Compliance~~

~~The **system** shall tolerate conducted electromagnetic fields so that, when tested in accordance with H.26.12.2.1,~~

- ~~for test level 2a: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;~~

~~b) for test level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE—Non-volatile lock-out excludes the use of **system restart**.~~

~~H.26.12.3 Radiated electromagnetic fields immunity evaluation~~ Immunity to radiated disturbances

~~H.26.12.3.1 Test level for radiated electromagnetic fields~~

~~Replacement:~~

Table H.18 (Table H.26.12.3.1 of the previous edition)—
Immunity to radiated electromagnetic fields

		Frequency range 80 MHz to 1 000 MHz	
Assessment criteria	Severity level	Test field strength V/m	
		80 MHz to 1 000 MHz	ISM and GSM bands
a)	2	3	6
b)	3	10	20

The levels in the ISM and GSM bands are chosen to be 6 dB higher.
 ISM: Industrial, scientific and medical radio-frequency equipment 433,92 ± 0,87 MHz.
 GSM: Group special mobile: 900 MHz ± 5,0 MHz, modulated by 200 Hz ± 1 % pulses of equal mark/space ratio (2,5 ms on and 2,5 ms off).

H.26.12.3.2 Test procedure

Addition:

The **system** has to be swept through the complete frequency range at least once with the **system** in each of the following ~~positions~~ operating modes:

- **start position**;
- **running position**;
- **lock-out position**.

~~Additional subclause:~~

The system shall tolerate radiated electromagnetic fields so that, when tested,

- for test level 2 of Table H.20 and Table H.21: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- for test level 3 of Table H.20 and Table H.21: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

~~H.26.12.3.101 Compliance~~

~~The **system** shall tolerate radiated electromagnetic fields so that, when tested in accordance with H.26.12.3.2,~~

- ~~a) for the values of Table H.18 (Table H.26.12.3.1 of the previous edition), assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;~~
- ~~b) for the values of Table H.18 (Table H.26.12.3.1 of the previous edition), assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE—Non-volatile lock-out excludes the use of **system restart**.~~

H.26.13 Test of influence of supply frequency variations

~~H.26.13.2 Test levels~~

~~Addition, after Table H.19:~~

~~The **system** shall tolerate supply frequency variations such that, when tested in accordance with H.26.13.3,~~

- ~~a) for the values of Table H.19, test level 2: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**. Variation in programme timings shall not exceed the percentage of applied frequency variations;~~
- ~~b) for the values of Table H.19, test level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE—Non-volatile lock-out excludes the use of **system restart**.~~

H.26.13.3 Test procedure

Addition:

The test shall be performed at least once with the system in each of the following ~~positions~~ operating modes:

- **start position**;
- **running position**;
- **lock-out position**.

The system shall tolerate supply frequency variations such that, when tested,

- a) for test level 2 of Table H.22: it shall continue to function in accordance with the requirements of this document. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**. Variation in programme timings shall not exceed the percentage of applied frequency variations;
- b) for test level 3 of Table H.22: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.14 Power frequency magnetic field immunity test

~~H.26.14.2 Test levels~~

~~Addition, after Table H.20:~~

~~The **system** shall tolerate power frequency magnetic fields so that, when tested in accordance with H.26.14.3,~~

- a) ~~for the values of Table H.20, severity level 2: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**.~~
- b) ~~for the values of Table H.20, severity level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.~~

~~NOTE – **Non-volatile lock-out** excludes the use of **system restart**.~~

H.26.14.3 Test procedure

Addition:

The test shall be done at least once with the system in each of the following ~~positions~~ operating modes:

- **start position;**
- **running position;**
- **lock-out position.**

The system shall tolerate power frequency magnetic fields so that, when tested,

- a) *for test level 2 of Table H.23: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**.*
- b) *for test level 3 of Table H.23: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.*

~~NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.~~

H.26.15 Evaluation of compliance

This subclause of Part 1 is not applicable.

H.27 Abnormal operation

This clause of Part 1 is applicable except as follows:

H.27.1.1.3

The third paragraph of a) is not applicable.

Add the following new item:

- h) For **proved igniter systems**, the **proved igniter operating value** shall not exceed or be less than, as applicable, the values declared by the manufacturer (Table 1 (7.2 of the previous edition), requirement 132).

H.27.1.1.5 Electronic circuit fault conditions

Table H.2124 (Table H.27.1 of the previous edition) – **Electrical/electronic component fault modes table**

Modification:

Add to ~~item 3 in note 7~~ the end of footnote i in Table H.2124 the following:

The nominal cycles are 250 000.

In Canada and in the USA, the nominal cycle is 100 000.

Replace note 12 as follows:

^{+2m)} For the assessment according H.27.1.1.3, the short-circuit **failure** mode is excluded if the requirements of Clause 20 are met. For the assessment according H.27.1.2, the short-circuit **failure** mode is excluded if the requirements of Clause 20 for **overvoltage category III** are met.

Modification:

Replace in the third bulleted item in footnote i, “a minimum of 100 000 cycles” by “250 000 nominal cycles (100 000 nominal cycles in Canada, Japan and in the USA)”.

Add, after the fourth bulleted item in footnote i, the following:

or

- the switching sequence of the relay contact configuration is integral to the part of the **class C control function**,
- and
- the contact function is switching under normal **operation** without load (no current flowing during make and current flowing during break shall be lower or equal 5 % of rated contact current),
- and
- the contact function is disconnecting the load under abnormal operation of the **burner control system** to reach **safety shut-down**,
- and
- the relay complies with Clause 17 at 1 000 000 cycles (load only at break) without resulting in short-circuit **failure** however applying 5 % of rated contact current,
- and
- the **control** complies with the requirements of 11.3.5.2.1 (measures to prevent **common cause errors**).

H.27.1.2 Protection against internal faults to ensure functional safety

H.27.1.2.2 Class B control function

This subclause of Part 1 is applicable for the **reset** from **lock-out** control function.

H.27.1.2.3 Class C control function

The modification applies to the French text only.

H.27.1.2.3.1 Design and construction requirements

Replacement of the last paragraph by the following:

The circuitry and the construction of the **system** shall be such that they meet the requirements of 11.3.101 to 11.3.113 inclusive, 11.4.101 to 11.4.107 and 11.101 and shall be appraised according to the requirements to H.27.1.2.3.2, H.27.1.2.3.3 and H.27.1.2.4 and under the test conditions and criteria of H.27.1.2.5.

H.27.1.2.3.2 First fault

Replacement:

Any **fault** (see Table H.21) in any one electronic component or any one **fault** together with any other **fault** arising from the first **fault** shall result in either

- a) the **system** proceeding to **safety shut-down** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 (terminals for fuel flow means are de-energized) and it remains in this condition as long as the **fault** appears; or
- b) the **system** proceeding to **lock-out** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 provided that the subsequent **reset** from **lock-out** under the same **fault** condition results in **lock-out**; or
- c) the **system** continuing to operate, the **fault** being identified during the next start-up sequence, the result being a) or b); or
- d) the **system** remaining operational in accordance with Clause 15.

For automatic **burner control systems** design for non-permanent **operation**, c) is applicable whereas c) is not applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.3.3 Second fault

Replacement of the third paragraph by the following:

For automatic **burner control systems** design for non-permanent **operation** the second **fault** shall be considered according to option a) whereas option b) is applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.4.2 Second faults introduced during lock-out or safety shut-down

Addition:

During assessment, the first **fault** shall not be considered to occur within 24 h after **lock-out** or **safety shut-down** is reached without an internal **fault**.

NOTE 101 While conducting this test, the **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. It is not necessary to wait 24 h before applying the **fault**. If the **fault** was applied before 24 h and unacceptable results were obtained, the **fault** can be applied 24 h after reaching **lock-out** or **safety shut-down**.

The “safe situation” as mentioned in H.27.1.2.4.1 is defined:

- as valve terminals remaining de-energized;
- as valve terminals are energized not longer than the safety time.

NOTE 102 For independent **flame detector** or **HTO detector** devices, the de-energization of the **flame signal** or **HTO signal** output resulting in a “flame off” or “HTO off” signal is equivalent to these definitions.

H.27.1.2.4.3 Second fault introduced during ~~lock-out or safety shut-down~~ defined state

Addition:

While conducting this test, the second **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. It is not necessary to wait 24 h before applying the second **fault**. If the second **fault** was applied before 24 h and unacceptable results were obtained, the initial **fault** shall be applied and then wait 24 h before applying the second **fault**.

Annex J (normative)

Requirements for **thermistor elements and controls using thermistors**

J.1 Scope

This clause of Part 1 is applicable except as follows:

J.1.1.1 Addition:

NOTE 101 A hot surface igniter is not considered to be a thermistor.

Annex BBAA
 (informative)

Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Table BBAA.1 – Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Item	Subclause	Remarks
Multitry system	2.2.107	Allowed or not
Automatic recycle	2.3.101	Allowed or not
Flame detector response time	2.3.103	Maximum time
Self-checking flame detector	2.3.105	Required or not
Flame detector self-checking rate	2.3.106	Minimum rate
Flame failure lock-out time	2.3.107	Maximum time
Flame failure response time	2.3.107	Maximum time
Flame failure re-ignition time	2.3.108	Maximum time
Ignition time	2.3.111	Maximum time
Non-volatile lock-out	2.3.112.1	Required or not
Volatile lock-out	2.3.112.2	Allowed or not
Main flame establishing period	2.3.113	Maximum time
Pilot flame establishing period	2.3.114	Maximum time
Post-ignition time	2.3.115	Maximum time
Pre-ignition time	2.3.116	Maximum time
Proved igniter	2.3.117	Required or not
Purge time	2.3.118	Minimum time
Post-purge time	2.3.118.1	Minimum time
Pre-purge time	2.3.118.2	Minimum time
Re-ignition	2.3.119	Allowed or not
Recycle time	2.3.120	Minimum time
Start-up lock-out time	2.3.125	Maximum time
Waiting time	2.3.126	Minimum time
Valve open period	2.3.127	Maximum time
Valve sequence period	2.3.128	Maximum time
Defined temperature limit for HTO	2.3.132	Minimum temperature
HTO detector response time	2.3.134	Maximum time
System for permanent operation	2.5.101	Required or not
System for non-permanent operation	2.5.102	Allowed or not

Annex BB (informative)

Specific regional requirements in Japan

BB.1 General

For the purposes of this International Standard, the specific regional requirements given as follows are applicable in Japan.

BB.1.1.101 Addition:

NOTE This regional Annex BB shows that JIS C 9730-2-5:2010 is identical to IEC 60730-2-5:2000+AMD1:2004 based on ISO/IEC Guide 21-1,8.2 Table 1, as Designation "identical" a) and b), Abbreviation "IDT".

BB.1.5 Normative references

Subclause 1.5 is applicable with following modifications:

Reference in Subclause 1.2 of Part 1 and 1.5 of this document	Replaced by	IDT/MOD
IEC 60384-16:2005	JIS C 5101-16:1999	IDT
IEC 60730-1 Ed. 5.0:2013	JIS C 9730-1:2016	MOD
IEC 60068-2-6	JIS C 60068-2-6:1999	IDT
IEC 61558-2-6, IEC 61558-2-16	JIS C 61558-2-6, IEC 61558-2-16	MOD

Annexes

Annex H – Requirements for electronic controls

H.26.10 Ring wave immunity test

This subclause is not applicable in Japan.

Table BB.1 – Comparison between JIS and adopted international standard

JIS C 9730-2-5:2010					IEC 60730-2-5:2010+AMD1:2004/Ed.3		
(I) JIS		(II) International standard No.	(III) International standard		(IV) Evaluation between JIS and International standard		(V) Reason and future changes
Clause No.	content		Clause No.	content	Evaluation In clause	Different technical content	
H.26	EMC		H.26	Same as JIS	Modified	Align with JIS C 9730-1 clause No.	To apply clause No. of the newest IEC documents.
Annex AA	Note 7)	-	Annex AA Note 7)	Same as JIS	Modified	Excluded relays certified in accordance with Clause 17.	The IEC has no Japanese deviation. (For IEC 60730-1:2013, Table H.24 footnote i), it is revised, Japanese practice is the same as Canada and USA.)
Total evaluation to issue between JIS C 9730-2-5:2010 and IEC 60730-2-5:2010+AMD1:2004: IDT							

Bibliography

Bibliography of Part 1 is applicable except as follows:

Addition:

IEC 60947 (all parts), *Low-voltage switchgear and controlgear*

IEC 60989:1991, *Separating transformers, autotransformers, variable transformers and reactors*

IEC 62282-3-100, *Fuel cell technologies – Part 3-100: Stationary fuel cell power systems – Safety*

ISO 13577 (all parts), *Industrial furnaces and associated processing equipment*

JIS C 9730-2-5, *Automatic electrical controls for household and similar use – Part 2-5: Particular requirements for automatic electrical burner control systems*

FINAL VERSION

**Automatic electrical controls –
Part 2-5: Particular requirements for automatic electrical burner control systems**



CONTENTS

FOREWORD.....	4
1 Scope and normative references.....	7
2 Terms and definitions.....	8
3 General requirements.....	15
4 General notes on tests.....	16
5 Rating.....	16
6 Classification.....	16
7 Information.....	18
8 Protection against electric shock.....	21
9 Provision for protective earthing.....	21
10 Terminals and terminations.....	21
11 Constructional requirements.....	22
12 Moisture and dust resistance.....	28
13 Electric strength and insulation resistance.....	28
14 Heating.....	29
15 Manufacturing deviation and drift.....	29
16 Environmental stress.....	31
17 Endurance.....	31
18 Mechanical strength.....	34
19 Threaded parts and connections.....	34
20 Creepage distances, clearances and distances through solid insulation.....	34
21 Resistance to heat, fire and tracking.....	35
22 Resistance to corrosion.....	35
23 Electromagnetic compatibility (EMC) requirements – Emission.....	35
24 Components.....	35
25 Normal operation.....	35
26 Electromagnetic compatibility (EMC) requirements – Immunity.....	35
27 Abnormal operation.....	35
28 Guidance on the use of electronic disconnection.....	35
Annex H (normative) Requirements for electronic controls.....	36
Annex J (normative) Requirements for thermistor elements and controls using thermistors.....	48
Annex AA (informative) Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable.....	49
Annex BB (informative) Specific regional requirements in Japan.....	50
Bibliography.....	51
Figure 101 – Pulse spark generation.....	21
Figure H.101 – Voltage variation test.....	40
Table 1 (7.2 of edition 3) – Required information and methods of providing information.....	19

Table H.1 (7.2 of the previous edition)	37
Table H.101 – Timing of short-term supply voltage variations.....	39
Table H.103 – Peak voltages.....	42
Table H.103 – Test levels for electrostatic discharge	43
Table AA.1 – Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable.....	49

INTERNATIONAL ELECTROTECHNICAL COMMISSION

AUTOMATIC ELECTRICAL CONTROLS –

Part 2-5: Particular requirements for automatic electrical burner control systems

FOREWORD

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This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60730-2-5 bears the edition number 4.1. It consists of the fourth edition (2013-11) [documents 72/922/FDIS and 72/929/RVD] and its amendment 1 (2017-08) [documents 72/1084/FDIS and 72/1103/RVD]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 60730-2-5 has been prepared by IEC technical committee 72: Automatic electrical controls.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2-5 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the fourth edition (2010) of that publication. Consideration may be given to future editions of, or amendments to, IEC 60730-1.

The title of IEC 60730-2-5 Ed. 4 has been updated to the title of IEC 60730-1 Ed. 5.0. However, IEC 60730-2-5 Ed. 4.0 has not been updated in accordance with the technical requirements in IEC 60730-1 Ed. 5.0.

This part 2-5 supplements or modifies the corresponding clauses in IEC 60730-1 so as to convert that publication into the IEC standard: Safety requirements for automatic electrical burner control systems.

Where this part 2-5 states "addition", "modification", or "replacement", the relevant requirement, test specification or explanatory matter in Part 1 should be adapted accordingly.

Where no change is necessary, this part 2-5 indicates that the relevant clause or subclause applies.

In the development of a fully international standard, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The "in some countries" notes regarding differing national practices are contained in the following subclauses:

- 2.3.127
- 6.11
- 15.7
- 17.16.102.1
- H.26.11.103
- Table H.21, Note 7

In this publication:

- 1) The following print types are used:
 - Requirements proper: in roman type;
 - *Test specifications: in italic type;*
 - Explanatory matter; in small roman type;
 - Words defined in Clause 2: **bold**.
- 2) Subclauses, notes, tables and figures which are additional to those in Part 1 are numbered starting from 101, *additional* annexes are lettered AA, BB, etc.

A list of all parts of the IEC 60730 series, under the general title *Automatic electrical controls* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

AUTOMATIC ELECTRICAL CONTROLS –

Part 2-5: Particular requirements for automatic electrical burner control systems

1 Scope and normative references

This clause of Part 1 is applicable except as follows:

1.1 Scope

This part of IEC 60730 applies to automatic electrical **burner control systems** for the **automatic control** of burners for oil, gas, coal or other combustibles intended to be used

- for household and similar use,
- in shops, offices, hospitals, farms and commercial and industrial applications.

This International Standard is applicable

- to a complete **burner control system**,
- to a separate **programming unit**,
- to a separate electronic high-voltage **ignition source**,
- to a separate **flame detector** and
- to a separate **high-temperature operation (HTO) detector**.

NOTE 1 Throughout this document, where it can be used unambiguously, the word "system" means "burner control system" and "systems" means "burner control systems".

NOTE 2 Throughout this document, the word "equipment" means "appliance and equipment."

This standard does not apply to thermoelectric flame supervision controls; thermoelectric flame supervision controls are covered by ISO 23551-6.

This document also applies to electrical **burner control systems** intended exclusively for industrial process applications e.g. those applications covered by ISO TC 244 (ISO 13577).

1.1.1 This document applies to the inherent safety, to the declared **operating values**, **operating times** and **operating sequences** where such are associated with burner safety and to the testing of automatic electrical **burner control systems** used in, on, or in association with, burners.

NOTE Requirements for specific **operating values**, **operating times** and **operating sequences** are given in the standards for appliances and equipment.

1.1.2 This document applies to AC or DC powered systems with a rated voltage not exceeding 660 V AC or 600 V DC.

1.1.3 This document does not take into account the **response value** of an **automatic action** of a **control**, if such a **response value** is dependent upon the method of mounting the **control** in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer applies.

1.1.4 This document applies also to systems incorporating **electronic devices**, requirements for which are contained in Annex H.

1.1.5 This document applies to systems using NTC or PTC thermistors, additional requirements for which are contained in Annex J.

1.1.6 This document includes systems responsive to flame properties and temperature for HTO.

1.2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60079-20-1:2010, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

ISO 23551-6:2014, *Safety and control devices for gas burners and gas-burning appliances – Particular requirements – Part 6: Thermoelectric flame supervision controls*

Replacement:

IEC 60127-1:2015, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

2 Terms and definitions

This clause of Part 1 is applicable except as follows:

2.2 Definitions of types of control according to purpose

NOTE Definition 2.2.23 is not applicable.

Additional definitions:

2.2.101

burner control system

system which includes a **programming unit**, a **flame detector** or, if applicable, an **HTO detector** and may include an **ignition source** and/or **ignition device** and which monitors the **operation** of fuel burners

Note 1 to entry: The various functions of the system may be in one or more housings.

2.2.102

flame detector

device which provides the **programming unit** with a signal indicating the presence or absence of flame

Note 1 to entry: It includes the **flame sensor** and may include an amplifier and a relay for signal **transmission**. The amplifier and relay may be in its own housing or combined with the **programming unit**.

2.2.103

flame sensor

device which senses the flame and provides the input signal to the **flame detector** amplifier

Note 1 to entry: Examples are optical sensors and flame electrodes (flame rods).

2.2.104

ignition source

electrical or electronic system component which provides energy to an **ignition device**

Note 1 to entry: It may be separated from or incorporated in the **programming unit**. Examples are ignition transformers and electronic high-voltage generators.

2.2.105

ignition device

device mounted on or adjacent to a burner for igniting fuel at the burner

Note 1 to entry: Examples are **pilot** burners, spark electrodes and hot surface igniters.

2.2.106

programming unit

device which controls the burner **operation** in a declared sequence from start-up to shut-down within declared timings and in response to signals from regulating, limiting and monitoring devices

2.2.107

multitry system

system that allows more than one **valve open period** during its declared **operating sequence**

2.2.108

HTO detector

device which provides the **programming unit** with a signal indicating presence or absence of **HTO**

Note 1 to entry: It includes the **HTO-sensor** and may include an amplifier and a relay for signal **transmission**. The amplifier and relay may be in its own housing or combined with the **programming unit**.

2.2.109

HTO-sensor

device which senses the temperature of a surface or a medium within the combustion chamber which is in direct contact with a flammable fuel-air mixture and provides a signal indicating presence or absence of **HTO**

2.2.110

auto-ignition temperature

AIT

lowest temperature (of a hot surface or the environment) at which an ignition of a flammable fuel/air mixture occurs

[SOURCE: IEC 60079-20-1:2010,3.3, modified : "or the environment" has been added in the parenthesis, "at which under specified test conditions" has been deleted and " flammable gas or vapour in mixture with air or air/inert gas" has been replaced by " flammable fuel/air mixture"]

2.2.111

high-temperature operation

HTO

operation on the basis of **auto-ignition temperature** which assures ignition and burning of fuel

Note 1 to entry: **High-temperature operation** is used e.g. in fuel cells (IEC 62282-3-100) and in industrial furnaces and associated processing equipment (ISO 13577) where ignition and burning is detected by means of sensing the temperature.

2.3 Definitions relating to the function of controls

2.3.30

T_{\max}

Replace "**switch head**" by "**burner control system**."

2.3.32

safety shut-down

Replacement:

de-energization of the main fuel flow means as the result of the action of a limiter, a cut-out or the detection of an internal **fault** of the system

Note 1 to entry: **Safety shut-down** may include additional actions by the system.

Additional definitions:

2.3.101

automatic recycle

automatic repetition of the start-up procedure, without manual intervention, following loss of the supervised flame and subsequent fuel supply shutoff

2.3.102

controlled shut-down

de-energization of the fuel flow means as a result of the opening of a control loop by a control device such as a **thermostat** leading the system to return to the **start position**

Note 1 to entry: **Controlled shut-down** may include additional actions by the system.

2.3.103

flame detector response time

period of time between the loss of the sensed flame and the signal indicating the absence of flame

2.3.104

flame detector operating characteristics

that function of the **flame detector** which indicates absence or presence of flame as the output signal of the **flame detector** relating to the input signal

Note 1 to entry: Normally the input signal is provided by a **flame sensor**.

2.3.104.1

signal for presence of flame

S_1

minimum signal which indicates the presence of flame when there was previously no flame

2.3.104.2

signal for absence of flame

S_2

maximum signal which indicates the loss of flame

Note 1 to entry: S_2 is less than S_1 .

2.3.104.3

maximum flame signal

S_{\max}

maximum signal which does not affect the timings or the sequence

2.3.104.4
signal for visible light flame simulation

S₃
minimum signal which indicates the presence of flame during the visible light **flame simulation** test

Note 1 to entry: **S₃** is less than **S₂**.

2.3.105
self-checking flame detector

flame detector which checks for correct **operation** of the **flame detector** and its associated electronic circuitry while the burner is in the **running position**

2.3.106
flame detector self-checking rate

frequency of the self-checking function of the **flame detector** (in number of **operations** per unit of time)

2.3.107
flame failure lock-out time
flame failure response time

period of time between the signal indicating absence of flame and **lock-out**

2.3.108
flame failure re-ignition time
relight time

period of time between the signal indicating absence of flame and the signal to energize the **ignition device**, during which the fuel supply is not shut off

2.3.109
flame signal

output signal of the **flame detector**

2.3.110
flame simulation

condition which occurs when the **flame detector** indicates the presence of flame when in reality no flame is present

2.3.111
ignition time

period of time during which the **ignition device** is energized

2.3.112
lock-out

process in which the system goes into one of the following **lock-out** conditions, following **safety shut-down**

2.3.112.1
non-volatile lock-out

condition such that a restart can only be accomplished by a manual **reset** of the system and by no other cause

2.3.112.2
volatile lock-out

condition such that a restart can be accomplished by either a manual **reset** of the system or by an interruption of the power supply and its subsequent restoration

2.3.113

main flame establishing period

period of time between the signal to energize the main fuel flow means and the signal indicating presence of the main burner flame

2.3.114

pilot flame establishing period

period of time between the signal to energize the **pilot** fuel flow means and the signal indicating presence of the **pilot** flame

2.3.115

post-ignition time

period of the **ignition time** between the signal indicating presence of flame and the signal to de-energize the **ignition device**

2.3.116

pre-ignition time

period of the **ignition time** between the signal to ignite and the signal to energize the fuel flow means

2.3.117

proved igniter

proved igniter system

system in which the fuel flow means is energized only after the availability of sufficient energy to ignite the fuel has been verified

Note 1 to entry: Examples are systems using spark supervision and those using proved hot surface igniters.

2.3.117.1

proved igniter operating value

signal which indicates that the **proved igniter** has the energy to ignite the fuel

2.3.117.2

igniter proving time

period of time between the signal to energize the **proved igniter** and the signal to energize the fuel flow means

2.3.117.3

igniter failure response time

period of time between loss of the supervised **proved igniter** and the signal to de-energize the fuel flow means

2.3.118

purge time

period during which air is introduced to displace any remaining air/fuel mixtures or products of combustion from the combustion zone and flue ways

Note 1 to entry: No fuel is admitted during this period.

2.3.118.1

post-purge time

purge time that takes place immediately following the shutting off of the fuel supply

2.3.118.2

pre-purge time

purge time that takes place between **initiation** of a burner control sequence and the admission of fuel to the burner

2.3.119
re-ignition
relight

process by which, following loss of the **flame signal**, the **ignition device** will be re-energized without interruption of the fuel flow means

2.3.120
recycle time

period of time between the signal to de-energize the fuel flow means following the loss of flame and the signal to begin a new start-up procedure

2.3.121
running position

position denoting that the main burner flame is established and supervised, or the burner is in **HTO** and supervised

2.3.122 Void

2.3.123
start position

position which denotes that the system is not in the **lock-out** condition and has not yet received the **start signal**, but can proceed with the start-up sequence if required

2.3.124
start signal

signal, for example, from a **thermostat**, which releases the system from its **start position**

2.3.125
start-up lock-out time

period of time between the signal to energize the fuel flow means and **lock-out**

Note 1 to entry: For systems which control two separate fuel flow means, two different **start-up lock-out times** are possible (first and second **start-up lock-out times**).

2.3.126
waiting time

period between the **start signal** and the signal to energize the **ignition device**

Note 1 to entry: For burners without fans, natural ventilation of the combustion chamber and the flue passages normally takes place during this time.

2.3.127
valve open period

for **multitry systems**, the period of time between the signal to energize the fuel flow means, and the signal to de-energize the fuel flow means, if proof of the supervised burner flame is not established

Note 1 to entry: In the USA, this period is referred to as the "trial-for-ignition period."

2.3.128
valve sequence period

for **multitry systems**, the sum of all valve opening periods prior to **lock-out**, if proof of the supervised burner flame is not established

2.3.129
system restart

process by which, after a **safety shut-down**, a full start-up procedure is automatically repeated

2.3.130

reset from lock-out function

function that provides **reset** from **lock-out** allowing the system to attempt a restart

Note 1 to entry: The **reset** function may be performed by various electric/electronic (mobile) devices.

2.3.131

common cause failures

failures of different items, resulting from a single event, where these **failures** are not consequences of each other

Note 1 to entry: **Common cause failures** should not be confused with common mode failures.

[SOURCE: IEC 60050-191:1990,191-04-23]

2.3.132

HTO detector response time

period of time between the temperature falling below the defined temperature limit for **HTO** and the signal indicating the absence of **HTO**

2.3.133

HTO detector operating characteristics

that function of the **HTO detector** which indicates absence or presence of **HTO** as the output signal of the **HTO detector** relating to the input signal

Note 1 to entry: Normally the input signal is provided by a **HTO-sensor**.

2.3.134

HTO response time

period of time between the signal indicating absence of **HTO** and proceeding to **safety shut-down** or to switch over to flame supervision

2.3.135

HTO signal

output signal of the **HTO detector**

2.5 Definitions of types of control according to construction

Additional definitions:

2.5.101

system for permanent operation

system which is intended to remain in the **running position** for longer than 24 h without interruption

2.5.102

system for non-permanent operation

system which is intended to remain in the **running position** for less than 24 h

Additional definitions:

2.101 Definitions relating to the type of burner (see 6.101)

2.101.1

continuous ignition

type of ignition which, once placed in **operation**, is intended to remain energized continuously until it is manually interrupted

2.101.2

continuous pilot

pilot which, once placed in **operation**, is intended to remain ignited continuously until it is manually interrupted

2.101.3

direct ignition

type of ignition which is applied directly to the main burner, without the use of a **pilot**

2.101.4

expanding pilot

form of **continuous pilot** where the **pilot** flame is increased or expanded when required to ignite the main burner and reduced either immediately after main burner ignition, or after the main flame is shut off

2.101.5

full rate start

condition in which the main burner ignition and subsequent flame supervision occur at full fuel rate

2.101.6

intermittent ignition

type of ignition which is energized when an appliance is called on to operate and which remains continuously energized during each period of main burner **operation** and where the ignition is de-energized when the main burner operating cycle is completed

2.101.7

intermittent pilot

pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner **operation** and where the **pilot** is automatically extinguished when each main burner operating cycle is completed

2.101.8

interrupted ignition

type of ignition which is energized prior to the admission of fuel to the main burner and which is de-energized when the main flame is established

2.101.9

interrupted pilot

pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished when the main flame is established

2.101.10

low rate start

condition in which main burner ignition occurs at low fuel rate

Note 1 to entry: Once ignition at low fuel rate occurs and the flame is proved, full main burner fuel rate may be admitted.

2.101.11

pilot

flame, smaller than the main flame, which is utilized to ignite the main burner or burners

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable except as follows:

4.1 Conditions of test

4.1.1 Replacement:

Unless otherwise specified, the system and each system component are tested as delivered, having been mounted as declared in Table 1 (7.2 of the previous edition), requirement 31, in the most unfavourable position when there is more than one position.

When a separate system component is submitted, the manufacturer shall provide those other system components which may be necessary to perform the relevant tests.

4.1.7 Not applicable.

4.2 Samples required

4.2.1 Replacement:

Unless otherwise specified, one sample shall be used for the tests of Clauses 5 to 14 inclusive. A different sample(s) shall be used for the tests of Clauses 15 to 17. At the option of the manufacturer, the tests of Clauses 18 to 26 including the relevant annexes may be conducted on a new sample or on the sample(s) used for the tests of Clauses 5 to 14 inclusive. The tests of Clause 27 shall be conducted on a new sample.

4.3 Instructions for test

4.3.2.1 Modification:

Delete "and those for a.c./d.c. at the more unfavourable supply."

4.3.2.4 Not applicable.

4.3.2.6 Replacement:

For systems marked or declared for more than one rated voltage or rated current, the tests of Clause 17 are made at the rated voltage and associated current (or vice versa) which produces the most unfavourable combination.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows:

6.1 According to nature of supply

6.1.1 Systems for a.c. only

Replace explanatory matter by the following requirement:

Systems intended for use on a.c. only supply shall only be used on a.c. supplies.

6.1.3 Not applicable.

6.3 According to their purpose

Additional subclauses:

- 6.3.101 – **burner control system**;
- 6.3.102 – **flame detector**;
- 6.3.103 – **programming unit**;
- 6.3.104 – **ignition device**;
- 6.3.105 – electronic high-voltage **ignition source**;
- 6.3.106 – **flame sensor**;
- 6.3.107 – **HTO detector**;
- 6.3.108 – **HTO-sensor**.

6.4 According to features of automatic action

6.4.1 Not applicable.

6.4.3 *Addition:*

Burner control systems are classified as having **Type 2 action**.

6.4.3.12 Not applicable.

Additional subclauses:

- 6.4.3.101 – **non-volatile lock-out** (Type 2.V);
- 6.4.3.102 – **volatile lock-out** (Type 2.W);
- 6.4.3.103 – non-permanent **operation** (Type 2.AC);
- 6.4.3.104 – permanent **operation** (Type 2.AD);
- 6.4.3.105 – spark supervision (Type 2.AE);
- 6.4.3.106 – air/pressure flow supervision (Type 2.AF);
- 6.4.3.107 – position-checked external devices (Type 2.AG);
- 6.4.3.108 – visible light **flame simulation** check (Type 2.AH);
- 6.4.3.109 – proved hot surface igniter (Type 2.AI).

6.7 According to ambient temperature limits of the switch head

6.7.1 *Modification:*

Replace "Control with a **switch head**" by "**System** and **system** components".

6.7.2 Modification:

Replace "Control with a **switch head**" by "**System** and **system** components".

6.10 According to number of cycles of actuation (M) of each manual action

6.10.5 to 6.10.7 Not applicable.

6.11 According to number of automatic cycles (A) of each automatic action

Addition:

NOTE In member countries of CENELEC, the minimum value is 250 000 automatic cycles. In Canada, China, in Japan and the USA, the minimum value is 100 000 cycles.

6.11.4 to 6.11.12 Not applicable.

6.15 According to construction

6.15.3 Not applicable.

6.16 Not applicable.

Additional subclauses:

6.101 According to type of burner

NOTE Classification could be according to burner **operation** (for example, forced draught) and type of fuel (for example, gas). See 2.101.1 to 2.101.11.

6.102 According to type of pilot

6.103 According to type of ignition

6.104 According to starting fuel rate

7 Information

This clause of Part 1 is applicable except as follows:

7.2.6 Replacement:

Except as indicated in 7.4, for integrated systems all information is provided by means of declaration (X). For incorporated systems not declared under requirement 50, the marking required is as indicated in Table 1 (7.2 of the previous edition). For incorporated systems declared under requirement 50, the only marking required is the manufacturer's name or trade mark and the **unique type reference** if other required marking is provided by documentation (D).

NOTE See the explanation of documentation (D) contained in 7.2.1.

7.2.9 Modification:

Replace "**T_{max}** other than 55 °C" by "**T_{max}** other than 60 °C" in the line for symbol for "Ambient temperature limits of **switch head**".

Table 1 (7.2 of edition 3) – Required information and methods of providing information (1 of 2)

Information	Clause or subclause	Method
<i>Modification:</i>		
<i>Replace the following requirements by:</i>		
4 Nature of supply (a.c. or d.c.)	4.3.2, 6.1	C
6 Purpose of system or system component	4.3.5, 6.3	D
7 The type of load controlled by each circuit ^{b)}	14, 17.3.1, 6.2, H.27.1.2	D
15 Degree of protection provided by enclosure ^{c)}	6.5.1, 6.5.2, 11.5	D
17 Which of the terminals are suitable for the connection of external conductors, and if they are suitable for line or neutral conductors, or both	6.6, 7.4.2, 7.4.3	D
22 Temperature limits of the system and system components if T_{\min} is lower than 0 °C, or T_{\max} other than 60 °C	6.7, 14.5, 14.7, 17.3	D
23 Temperature limits of mounting surfaces (T_s)	6.12.2, 14.1, 17.3	D
26 Number of cycles of actuation (M) for each manual action ¹⁰¹⁾	6.10	X
28 Not applicable		
31 Method of mounting the system and each system component ^{e)}	4.1.1, 11.6	D
34 Details of any limitation of operating time	6.4.3.103, 6.4.3.104, 14, 17	D
37 Not applicable		
38 Not applicable		
40 Additional features of Type 2 actions	6.4.3	D
41 Not applicable		
42 Not applicable		
44 Not applicable		
46 Operating sequence	2.3.13, 11.3.108, 15	D
48 Not applicable		
50 System or system components intended to be delivered exclusively to the equipment manufacturer	7.2.1, 7.2.6	X
<i>Add the following additional requirements:</i>		
101 Maximum flame detector response time (if applicable)	2.3.103, 15	D
102 Minimum flame detector self-checking rate (if applicable)	2.3.106, 11.3.107, 15	D
103 Maximum flame failure lock-out time or Maximum flame failure response time (if applicable)	2.3.107, 15	D
104 Maximum flame-failure re-ignition time (if applicable)	2.3.108, 15	D
105 Maximum ignition time (if applicable)	2.3.111, 15	D
106 Maximum main flame establishing period (if applicable)	2.3.113, 15	D
107 Maximum pilot flame establishing period (if applicable)	2.3.114, 15	D
108 Maximum post-ignition time (if applicable)	2.3.115, 15	D
109 Maximum pre-ignition time (if applicable)	2.3.116, 15	D
110 Void		
111 Minimum post-purge time (if applicable)	2.3.118.1, 15	D
112 Minimum pre-purge time (if applicable)	2.3.118.2, 15	D
113 Minimum recycle time (if applicable)	2.3.120, 15	D
114 Maximum start-up lock-out time (if applicable)	2.3.125, 15	D

Table 1 (7.2 of edition 3) – **Required information and methods of providing information** (2 of 2)

Information		Clause or subclause	Method
115	Minimum waiting time (if applicable)	2.3.126, 15	D
116	Type of burner	6.101	D
117	Type of pilot	6.102, 2.101.2, 2.101.4, 2.101.7, 2.101.9, 2.101.11	D
118	Type of ignition	2.101.1, 2.101.3, 2.101.6, 2.101.8, 6.103	D
119	See Annex H		
120	Means for protecting setting of timings	11.3.4	X
121	See Annex H		
122	Resistance to vibration	17.1.3, 17.16.103	D
123	S₁ (signal for presence of flame)	2.3.104.1, 15.5, 15.6, 15.7	D
124	S₂ (signal for absence of flame)	2.3.104.2, 15.5, 15.6, 15.7	D
125	S_{max} (maximum flame signal , if applicable) ¹⁰³⁾	2.3.104.3, 15.5, 15.6, 15.7	D
126	Electronic high-voltage ignition spark gap ¹⁰²⁾	13.2.101	D
127	Other system components for use with the submitted components to provide a complete system	2.2.101, 2.2.102, 2.2.104, 2.2.106	D
128	For each valve opening period, the maximum time (if applicable)	2.3.127, 11.3.113, 15.5 p)	D
129	Maximum valve sequence period (if applicable)	2.3.128, 11.3.112, 15.5 q)	D
130	S₃ (signal for visible light flame simulation)	2.3.104.4, 11.3.110	X
131	For proved igniters , the characteristics (energy, current, voltage, resistance, temperature, etc.) which establish that the proved igniter has the energy to ignite the fuel	2.3.117	D
132	Proved igniter operating value (Minimum and/or maximum, as applicable)	2.3.117.1, 15.7, 17.16.108, H.27.1.1.3	D
133	Maximum igniter proving time (If applicable)	2.3.117.2, 15.5	D
134	Maximum igniter failure response time (If applicable)	2.3.117.3, 15.5	D
135	Type of lock-out	2.3.112, 11.3.108	D
136	See Annex H		
137	External overcurrent device (if applicable)	11.3.5.2.1a)	D
138	Maximum short circuit current as declared	11.3.5.2.1b)	D
139	The defined temperature limit for HTO	11.3.114	D
140	HTO detector response time	11.3.114	D

NOTES

Additional notes:

¹⁰¹⁾ For 17.16.105, the number of **manual actions** for **lock-out** re-set is a minimum of 6 000.

¹⁰²⁾ If a range is declared, the maximum value is used for the test of 13.2.102 and 13.2.103.

¹⁰³⁾ **S_{max}** shall be declared for those systems in which the **maximum flame signal** affects timings or sequence.

8 Protection against electric shock

This clause of Part 1 is applicable except as follows:

8.1 General requirements

Additional subclause:

8.1.101 High-voltage ignition sources

Provision shall be made for protection against contact with high-voltage **ignition sources** having any of the following characteristics:

- a) for continuous spark ignition (pulses within the mains frequency range):
 - the maximum voltage is higher than 10 kV (peak), and/or
 - the maximum current is higher than 0,7 mA (peak);
- b) for pulse spark ignition: (see Figure 101)
 - the charge of an individual ignition pulse exceeds 100 μC , and
 - the duration (d) is greater than 0,1 s, and
 - the interval (i) between individual ignition pulses is less than 0,25 s.

Either the system manufacturer shall provide a warning that is visible when the high-voltage **ignition source** is mounted as in **normal use**, or the equipment manufacturer shall be advised of the need to provide such protection or a warning.

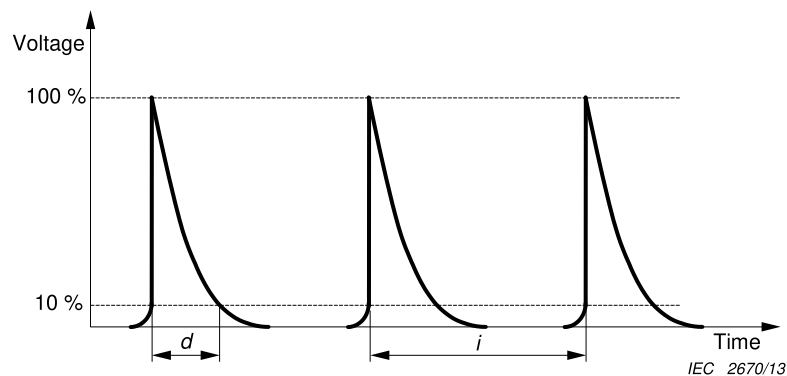


Figure 101 – Pulse spark generation

8.3 Capacitors

Not applicable.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable except as follows:

10.2.4 Flat push-on connectors

Additional subclause:

10.2.4.101 Direct plug-in connections

Systems designed for direct plug-in connection to a sub-base shall be so constructed that they withstand the forces of normal insertion and withdrawal in such a manner that compliance with this document is not impaired.

Compliance is checked by performing 10 insertions and withdrawals according to the manufacturer's instructions.

After this test, no significant displacement or damage shall occur.

NOTE The terminals used for direct plug-in connections between the system and/or system components and their sub-bases are not considered flat push-on connectors.

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

11.3 Actuation and operation

11.3.4 Setting by the manufacturer

Replacement:

Adjustment means used for the **setting** of timings shall be secured by means providing protection against access by uninstructed persons or shall be declared as requiring such protection in the application.

NOTE For example, such adjustment means can

- 1) be sealed with a material suitable for the temperature range of the system and/or system components such that tampering is apparent, or
- 2) consist of special parts only available from the manufacturer, or
- 3) be accessible only with the use of **special-purpose tools** or access codes.

Compliance is checked by inspection. Where sealing is used, inspection is done before and after the tests of Clause 17.

11.3.5 Contacts – General

11.3.5.2 Systems of **class C control functions** shall include at least two switching elements to directly de-energize the safety relevant terminals.

NOTE 1 The **burner control system** is a **class C control function**.

NOTE 2 A single relay operating two independent contacts is considered to be only one switching element.

Designs where relays are used as switching elements, a non-replaceable fuse (see Table H.24 Note I) in series with two independent relay contacts with I_N fuse $< 0,6 * I_e$ relay, are considered to comply with the following requirements for prevention of common cause **failure**.

NOTE 3 I_N : values for the fuse (see IEC 60127-1:2015, 3.16);

I_e : rated operational current of the contact (see IEC 60947-1:2007; 4.3.2.3)

In Part 1, the term

- “*safety related output terminals*” is equivalent to “*valve terminals*”.
- “*safety shut-down*” shall be used as defined in this document,
- “*control*” shall be used as “*burner control systems*”.

11.3.9 Pull-cord actuated control

Not applicable.

Additional subclauses:

11.3.101 Burner control circuits

Circuits employing **burner control systems** used in earthed supply systems shall be two-wire, one-side nominally earthed. Devices intended to open such a circuit shall be connected to the unearthed side of the supply circuit.

11.3.102 Circuits employing **burner control systems** used in unearthed supply systems shall be two-wire. All devices intended to open such circuits shall be connected to the same side of the supply circuit.

11.3.103 Circuits employing **burner control systems** used in earthed three-phase supply systems shall be four-wire. Devices intended to open such circuits shall be connected to all three phases.

11.3.104 Circuits employing **burner control systems** used in unearthed three-phase supply systems shall be three-wire. Devices intended to open such circuits shall be connected to two or three phases.

11.3.105 If the system initiates a signal to energize the fuel flow means at less than 85 % rated voltage for a.c. and less than 80 % rated voltage for d.c., the system shall comply with the following:

- a) in the **running position**, the system shall proceed to **safety shut-down** or operate with the timings measured at declared ambient temperatures as declared in Table 1 (7.2 of the previous edition), requirements 101 to 104, inclusive;
- b) in any other position, the **operating sequence** shall comply with the declarations of Table 1 (7.2 of the previous edition), requirement 46. The **start-up lock-out time** shall not exceed twice the value declared in Table 1 (7.2 of the previous edition), requirement 114.

Compliance is checked by H.26.5.4.

11.3.106 The system shall provide a safe start check that will cause a), b) or c) to occur if the **failure** results in a flame before the fuel flow means are energized:

- a) the system shall fail to start the **operating sequence**;
- b) the system shall lock out within the time declared in Table 1 (7.2 of the previous edition), requirement 103;
- c) the system shall remain in pre-purge.

NOTE The system can remain in conditions a) or c) until the **fault** clears.

*For systems which incorporate **electronic devices**, compliance is determined by the tests of Clause H.27.*

*For systems not subject to the tests of Clause H.27, a **flame signal** shall be simulated and introduced at the start of the flame establishing period until a), b) or c) occurs.*

11.3.107 Systems declared as Type 2.AD shall perform a self-check at least once every hour, when the system is in the **running position**.

Systems declared in Table 1 (7.2 of the previous edition), requirement 102, have the self-checking rate evaluated as part of the declared sequence and timings. This requirement shall be evaluated in Clauses 15, 17 and H.27.1.2.

11.3.108 Systems shall perform the declared **operating sequence**.

11.3.108.1 The electric circuit of the **actuating means** of the **lock-out** device shall be checked during each start-up sequence.

11.3.108.2 The fuel flow means shall not be energized before the **ignition device**.

11.3.108.3 **Re-ignition** is only permitted when the system is in the **running position**.

11.3.108.4 **Automatic recycle** is only permitted when the system is in the **running position**.

11.3.108.5 If no flame is detected at the end of the first or second **start-up lock-out time** the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

Compliance with 11.3.108 is checked by inspection and by test.

11.3.108.6 If no flame is detected at the end of the **flame failure lock-out time** or **flame failure response time**, the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

11.3.108.7 After a **safety shut-down** or after a **volatile lock-out reset**, the **operating sequence** may proceed only with a **system restart**.

11.3.109 If the wiring diagram provided by the manufacturer indicates an input to the system from an external limiter or cut-out, then **operation** of this external device shall lead to at least **safety shut-down**.

Compliance is checked by examination of the circuit design.

11.3.110 **Visible light flame simulation test**

Flame detectors classified as Type 2.AH shall have a check to discriminate between **flame simulation** and **flame signals** originating from real flame. Examples of suitable checks are:

a) prior to the signal to energize the fuel flow means during each start-up sequence, the system shall check for the presence of a **flame signal** that is greater than or equal to **S₃**. If such a signal is detected, the system shall proceed to **lock-out** or shall interrupt the start-up sequence;

for the above test, **S₃** shall be less than **S₂**;

or

b) after performing a **controlled shut-down**, the system shall check for the presence of a **flame signal** which is less than or equal to **S₂**. If such a signal is detected, the system shall proceed to **lock-out** or shall prevent the next start-up sequence.

11.3.111 For **multitry systems**, the system shall go to **lock-out** at the end of the **valve sequence period**.

11.3.112 For **multitry systems**, further **valve open periods** may be initiated either as a result of loss of supervised flame during the **running position** or **failure** to prove supervised flame during the declared **valve sequence period**.

NOTE **Re-ignition** (see 11.3.108.5) is also allowed if declared.

11.3.113 For **multitry systems**, the **valve open periods** may have different values during the **valve sequence period**.

11.3.114 For **controls** intended for **HTO** using **HTO-sensors**, the temperature shall be monitored. In the event the temperature falls below the defined temperature limit for **HTO**, the **control** shall proceed to **safety shut-down** or switch over to flame supervision (e.g. ionization, UV, IR etc.). This function (including sensor, detector and programming unit) shall be a **class C control function** with **type 2 action**.

The defined temperature limit for **HTO** (see Table 1, requirement 139) shall be the temperature value, which includes the auto-ignition temperature, given in IEC 60079-20-1 or otherwise specified by the product standard, and the tolerances of the signal processing circuit including the sensor.

11.4 Actions

11.4.3 Type 2 action

Replacement:

Any **type 2 action** shall be so designed that the **manufacturing deviation** and **drift** of its **operating value**, **operating time** or **operating sequence** is within the limits declared in Table 1, requirements 46, 101 to 115 inclusive, and 123 to 125 inclusive, 139 and 140.

11.4.15 Not applicable.

Additional subclauses:

11.4.101 Type 2.V action

A Type 2.V action shall be so designed that a restart can only be accomplished by a manual **reset** of the system.

Systems classified as Type 2.V shall have a **reset** mechanism classified as Type 2.J.

Compliance is checked by inspection and by test.

11.4.102 Type 2.W action

A Type 2.W action shall be so designed that a restart can only be accomplished by either a manual **reset** or an interruption of the power supply and its subsequent restoration.

Compliance is checked by inspection and by test.

11.4.103 For systems with remotely mounted **reset** buttons, a short circuit between the connecting cables or between the connecting cables and earth shall not result in a **reset**.

11.4.104 Systems classified as Type 2.AE shall perform spark supervision prior to energization of the fuel flow means.

11.4.105 Systems classified as Type 2.AF shall check for correct function of external air pressure/flow control.

The system shall perform **safety shut-down** or **lock-out** or shall fail to start if a positive external air pressure/flow control signal is detected prior to start-up.

The system shall perform **safety shut-down** or **lock-out** if insufficient external air pressure/flow is detected during the **purge time** or when the system is in the **running position**.

11.4.106 Systems classified as Type 2.AG which perform position checks during or prior to the start-up sequence shall continue with the **operating sequence** only after these position checks have been successfully performed.

Compliance with 11.4.103 to 11.4.106 inclusive is checked by inspection and by test.

11.4.107 Systems classified as Type 2.AI shall perform hot surface igniter supervision prior to energization of the fuel flow means.

11.10 Equipment inlets and socket-outlets

11.10.2 Not applicable.

11.11 Requirements during mounting, maintenance and servicing

11.11.6 Not applicable.

11.13 Not applicable.

Additional subclauses:

11.101 Flame detector constructional requirements

11.101.1 Flame detector devices using infrared sensors shall only react to the flicker property of the flame.

11.101.2 Flame detector devices using ionization sensors (flame rods) shall only make use of the rectification property of the flame.

11.101.3 Flame detector devices using UV-tubes shall have sufficient checks for ageing of the UV-tubes.

NOTE Examples of suitable checks are

- automatic periodic supervision of the sensor function;
- a check of the UV-tube during the **purge time** with a voltage 15 % higher than that applied to the UV-tube during the remainder of the **operating sequence**;
- a check that the flame relay has dropped out after each **controlled shut-down** with the amplifier continually energized.

11.101.4 An open circuit of the **flame sensor/HTO-sensor** or its connecting cables shall cause loss of the **flame signal/HTO-sensor signal**.

11.101.5 Flame detectors using UV sensors other than UV tubes shall not react to infrared light. Such **flame detectors** shall not indicate a signal for the presence of flame when the sensor is illuminated with 10 lx or less at a colour temperature of 2 856 K with the spectrum being cut off below the wavelength of 400 nm by means of a filter.

11.101.6 Sensors for visible light are not allowed if the illumination intensity is lower than 0,5 lx during **operation**. Systems using sensors for visible light shall not give a detect-of-**flame signal** during **operation** below an illumination intensity of 0,5 lx.

11.101.7 HTO-sensors shall only react to temperature.

NOTE For selecting the position of the **HTO-sensor** in the application, the effect of exposing it to radiant heat directly from the flame is taken into account.

Compliance with 11.101.1 to 11.101.7 inclusive is checked by inspection, test and/or measurement.

11.102 Reset from lock-out function

11.102.1 General

For **automatic controls**, provisions are present to ensure that the appliance can be **reset** from a **lock-out** condition (e. g. caused by overheating of the appliance or no flame establishment).

Traditional methods for resetting heating appliances are:

- conventional mechanical **reset** switch (no or minor simple electronic components present);
- removing the power supply to the control unit (only accepted in case of **volatile lock-out** applications).

New technologies provide more complex **reset** devices, such as:

- a) remote **reset** devices (e.g. through communication lines/protocols);
- b) intelligent complex **reset** devices (e.g. by means of additional hardware and/or software);
- c) infrared or radio frequency controlled **reset** devices;
- d) combinations of a) and b) and c) (e.g. through Internet by means of an interface and a portable telephone).

11.102.2 Performance requirements

The **reset from lock-out function** is a **class B control function** according H.27.1.2.2.

A **reset** action from **lock-out** shall be a **manual action**. An automatic **reset** (e.g. **resets** generated by automatic devices, like **timers**, etc.) shall not be possible unless it is accepted by specific application standards.

The **reset** device shall be capable of resetting the **system** in a proper way. Unintended or spontaneous **resets** from lockout shall not occur.

Whenever the **reset** function is performed by a mobile device, at least two **manual actions** are required to activate a **reset**.

Any **fault** within the **reset** function shall not cause the appliance to operate outside the applicable requirements. It shall be detected before the next start-up or shall not prevent the appliance from going to shut-down or **lock-out**.

For **reset** functions where the **manual action** is initiated without being within the visible sight of the appliance, the following additional requirements apply:

- actual status and relevant information of the process under control shall be visible to the **user** before, during and after the **reset** action;

- maximum number of **resets** shall be limited. Where it is not specified in the specific application standard, the number of **resets** shall be limited to five actions within a time span of 15 min or less. Following this, any further **resets** shall be denied unless the appliance is checked.

If the **reset** is activated by manual switching a **thermostat** or device with a similar function, this shall be declared by the manufacturer for approval with the final appliance.

12 Moisture and dust resistance

This clause of Part 1 is applicable.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable except as follows:

13.1 Insulation resistance

Not applicable.

13.2 Electric strength

Additional subclauses:

13.2.101 The electric strength of the high-voltage side of an electronic high-voltage **ignition source** is not checked by the test of 13.2 to 13.2.4 inclusive, but by the tests of 13.2.102 to 13.2.103, which are conducted immediately after the humidity treatment of 12.2.7 and 12.2.8.

NOTE For electronic high-voltage **ignition sources** which are built into the printed circuit board, additional details of the test methods can be agreed between the manufacturer and the test house.

13.2.102 The input supply terminals of the electronic high-voltage **ignition source** are to be connected to a variable voltage supply at rated input mains frequency. The output voltage is measured at $1,0 V_R$ and $1,1 V_R$ with the spark gap as declared in requirement 126 of Table 1 (7.2 of the previous edition). Then the electronic high-voltage **ignition source** is subjected to the following tests:

- a) all connections to the output terminals are removed. Initially, a voltage not exceeding the rated voltage is applied. Then the input voltage is gradually increased until 150 % of output voltage measured in 13.2.102 (at $1,0 V_R$) is achieved. The output voltage is maintained at that value for 1 min; or
- b) with the input voltage at $1,1 V_R$, the electrode gap is increased from that declared in requirement 126 of Table 1 (7.2 of the previous edition) until either 150 % of the output voltage measured in 13.2.102 (at $1,0 V_R$) is achieved or until the output voltage no longer increases, whichever occurs first. This output voltage is maintained for 1 min; or
- c) if test methods a) and b) cannot be applied, a test method shall be agreed between manufacturer and test authority in order to achieve 150 % of the output voltage measured in 13.2.102 at $1,0 V_R$ or the highest possible output voltage for the device. This output voltage is maintained for 1 min.

13.2.103 *Compliance is determined by measuring the output voltage with $1,1 V_R$ applied to the input terminal and with the spark gap restored to that declared in requirement 126 of Table 1 (7.2 of the previous edition), if applicable. The measured output voltage shall be within ± 10 % of the value measured in 13.2.102 at $1,1 V_R$.*

For 13.2.102 a), b) and c), flashovers which occur at an air gap provided to protect the circuitry are ignored. Glow discharges at the output terminal are neglected.

14 Heating

This clause of Part 1 is applicable except as follows:

14.3 Not applicable.

14.4.2 Not applicable.

14.4.3.1 to 14.4.3.3 Not applicable.

14.4.3.4 *Modification:*

*Replace "other **automatic controls**," by "**systems**".*

14.4.4 Not applicable.

14.5.1 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6.2 Not applicable.

14.7 *Modification:*

*Replace "**switch head**" by "**system**".*

Modification to Table 13 (14.1 of the previous edition):

The section entitled "Accessible surfaces of handles, knobs, grips and the like used for carrying and transporting the control" is not applicable.

15 Manufacturing deviation and drift

This clause of Part 1 is replaced by the following:

15.1 Systems shall have adequate consistency of manufacture with regard to their declared **operating times, operating sequences, flame detector operating characteristics, HTO detector operating characteristics and proved igniter operating value.**

15.2 *Compliance is checked by the tests of 15.5, 15.6 ad 15.7.*

15.3 The appropriate **operating time, operating sequence, flame detector operating characteristics, HTO detector operating characteristics and proved igniter operating value** shall be recorded for the sample.

15.4 Three tests shall be conducted for each **operating time, each operating sequence, flame detector operating characteristics, HTO detector operating characteristics and each proved igniter operating value** declared.

15.5 Operating times

Each of the following **operating times** which are declared applicable in Table 1 (7.2 of the previous edition) shall be measured at a voltage of $0,85 V_R$ a.c. or $0,80 V_R$ for d.c. and at a temperature of T_{min} .

Measurements shall also be taken at a voltage of $1,1 V_R$ and a temperature of T_{max} .

None of the times recorded shall exceed the manufacturer's declared maximum times nor be less than the manufacturer's declared minimum times, whichever is applicable.

- a) **flame detector response time;**
- b) **flame detector self-checking rate;**
- c) **flame failure lock-out time or flame failure response time;**
- d) **flame failure re-ignition time (relight time);**
- e) **ignition time;**
- f) **main flame establishing period;**
- g) **pilot flame establishing period;**
- h) **post-ignition time;**
- i) **pre-ignition time;**
- j) Void;
- k) **post-purge time;**
- l) **pre-purge time;**
- m) **recycle time;**
- n) **start-up lock-out time;**
- o) **waiting time;**
- p) valve opening period;
- q) **valve sequence period;**
- r) **igniter proving time;**
- s) **igniter failure response time**
- t) **HTO detector response time.**

NOTE For test purposes, the **flame detector operating characteristics** (S_1 and/or S_2 and/or S_{max}) can be artificially simulated.

15.5.4 Not applicable.

15.6 Operating sequence

The **operating sequence** shall be tested at a voltage of $0,85 V_R$ a.c. or $0,80 V_R$ for d.c. and at a temperature of T_{min} . A test shall also be conducted at a voltage of $1,1 V_R$ and a temperature of T_{max} .

The **operating sequence** shall be as declared.

NOTE For test purposes, the **flame detector operating characteristics** (S_1 and/or S_2 and/or S_{max}) can be artificially simulated.

15.7 Flame detector operating characteristics, HTO detector operating characteristics and proved igniter operating value

The operating characteristics of **flame detectors**, **HTO detector** and **proved igniter operating value** shall be measured under the following conditions:

- a) at V_R and (20 ± 5) °C;
- b) at $0,85 V_R$ and 0 °C or T_{min} , whichever is lower, and
- c) at $1,1 V_R$ and 60 °C or T_{max} , whichever is higher.

The measured values shall be as declared in Table 1 requirements 123, 124, 125, 132 and 139 as applicable.

The details of the measuring equipment shall be arranged between the manufacturer and the test house.

If a lamp is used for response to the visible range of light, it shall have a colour temperature of 2 856 K.

NOTE The preceding paragraph is not applicable in the USA and Canada.

16 Environmental stress

This clause of Part 1 is applicable, except as follows:

16.2.4 Replacement:

In addition, the appropriate tests of Clause 15 shall be repeated, only at room temperature, after each of the above tests. The values in these tests shall not differ from the values declared in Table 1 (7.2 of the previous edition).

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.1 General requirements

Replacement:

17.1.1 Systems including those submitted in or with an appliance shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses that occur in **normal use**.

17.1.2 *Compliance is checked by the tests indicated in 17.1.3.*

17.1.3 Test sequence and conditions

In general, the sequence of tests is:

- for electronic **systems**, the thermal cycling test specified in 17.16.101;
- endurance test of automatic and **manual action** at normal operating rate specified in 17.16.102;
- vibration test of 17.16.103, if declared;
- endurance test of **automatic action** at accelerated rate specified in 17.16.104.

NOTE For test conditions, see 17.2 and the relevant tests of 17.16.

The number of **operations** performed during 17.16.101, 17.16.102 and 17.16.104 is recorded. When the actual number of automatic cycles completed is equal to the number declared in Table 1 (7.2 of the previous edition) requirement 27, this test sequence is concluded and the following sequence is performed:

- **lock-out reset** test of 17.16.105;
- endurance test of 17.16.106.1, if applicable;
- electrical strength requirements specified in 17.16.107;
- evaluation of compliance specified in 17.16.108.

Whenever possible the tests of 17.16.101 to 17.16.105 may be combined.

17.3 (except 17.3.1) to **17.15** Not applicable.

17.16 Tests for particular purpose systems

Additional subclauses:

17.16.101 Thermal cycling test for electronic systems

The purpose of the test is to cycle components of an electronic circuit between the extremes of temperature likely to occur during **normal use** and which may result from ambient temperature variation, mounting surface temperature variation, supply voltage variation or the change from an operating condition to a non-operating condition and vice versa.

The following conditions shall form the basis of the test.

- a) Duration of test: 14 days
- b) Electrical conditions

The **system** is loaded according to the ratings declared by the manufacturer, the voltage then being increased to $1,1 V_R$ except that for 30 min during each 24 h period of the test the voltage is reduced to $0,9 V_R$. The change of voltage shall not be synchronized with the change of temperature. Each 24 h period shall also include at least one period in the order of 30 s during which the supply voltage is switched off.

- c) Thermal conditions

The ambient temperature and/or the mounting surface temperature are varied between T_{max} and T_{min} to cause the temperature of the components of the electronic circuit to be cycled between their resulting extremes. The rate of ambient and/or mounting surface temperature change shall be in the order of $1\text{ }^{\circ}\text{C}/\text{min}$ and the extremes of temperature maintained for approximately 1 h. Care shall be taken to avoid the occurrence of condensation during this test.

- d) Rate of **operation**

During the test, the **system** shall be cycled through its operational modes at the fastest rate possible up to a maximum of six cycles/min subject to the need to cycle components of the electronic circuit between their temperature extremes.

17.16.102 Endurance test of automatic and manual action at normal operating rate

17.16.102.1 Test sequence and conditions

The test is carried out with the terminals loaded with the maximum current and the minimum power factor declared by the manufacturer.

The **system** and its **flame detector** and/or **HTO detector** are tested under the following conditions:

a) 45 000 **operations** at V_R and $(20 \pm 5) ^\circ\text{C}$;

NOTE In the USA and Canada, if the **system** is electro-mechanical, this test is performed at T_{max} .

b) 2 500 **operations** at T_{max} and $1,1 V_R$ or $1,1$ times the upper limit of the rated voltage range;

c) 2 500 **operations** at T_{min} and $0,85 V_R$ or $0,85$ times the lower limit of the rated voltage range for a.c. and $0,80 V_R$ or $0,80$ times the lower limit of the rated voltage range for d.c.

The **HTO** function, if applicable shall be included in the sequence.

17.16.103 Vibration test

Systems declared in Table 1 (7.2 of the previous edition), requirement 122 are subjected to the vibration test of IEC 60068-2-6 as follows:

Cycling rate:	as declared
Loaded at:	$1,1 V_R$
Frequency range:	10 Hz to 150 Hz
Acceleration amplitude:	1 g or higher if declared by the manufacturer
Sweep rate:	1 octave/min
No. of sweep cycles:	10
No. of axes:	3, mutually perpendicular

17.16.104 Endurance test of automatic action at accelerated rate

This test shall be conducted at V_R , I_R and T_{max} .

The following means may be used to accelerate the test time of the **systems**:

- substitution of the components of the electronic circuit previously found acceptable under the abnormal **operation** test of Clause H.27;
- modification of control circuits to eliminate the portions of control programming that do not affect the **operating time** of the **system** or **system** component being tested;
- applying additional heating or external cooling to the thermal **timers** in the manner that does not alter the normal operating characteristics of the **timer** other than its timing.

NOTE The electromechanical components can be tested separately under the operating conditions to which they are subjected when incorporated into the **system** circuit, including the electrical loading of the contacts.

An additional sample may be required for this test.

17.16.105 Lock-out reset test

The **system** is also tested under the following **lock-out** conditions, mounted as declared in Table 1 (7.2 of the previous edition), requirement 31:

- the first half of the declared cycles (see requirement 26 and note 101 to Table 1 (7.2 of the previous edition)), without flame presence;
- the second half of the declared cycles, the flame disappearing during **operation**.

During the tests described above, the **system** is operated in such a way that the normal start-up sequence is performed.

The repetitions of the sequence shall be compatible with the method of **operation** of the **system** and shall be dependent on the cycling rate, if any, declared by the manufacturer.

17.16.106 Components of systems which are declared for operation in an ambient temperature above 125 °C

17.16.106.1 Endurance test

For **system** components which are declared in Table 1 (7.2 of the previous edition) requirement 22, for **operation** in an ambient temperature above 125 °C, but not subjected to this temperature during the tests of 17.16.101 to 17.16.104, the **system** components are mounted as declared in Table 1 (7.2 of the previous edition), requirement 31. The **system** components are placed in a test chamber and cycled for the declared number of cycles.

During the "ON" cycle, the temperature of the **system** components is raised to within + 5 % of the maximum operating temperature declared by the manufacturer.

During the "OFF" cycle, the test chamber heat source is interrupted and the **system** components cooled naturally or by passing room temperature air over the components as specified by the manufacturer, until the temperature is reduced to 125 °C or less as necessary to permit the **system** to complete the current cycle.

17.16.107 Electric strength requirements

After all the tests of 17.16.101 to 17.16.107 inclusive, the requirements of 13.2 shall apply, with the exception that the samples are not subjected to the humidity treatment before the application of the test voltage.

17.16.108 Evaluation of compliance

After completion of all applicable tests of 17.16.101 to 17.16.107 inclusive, the sample shall be retested according to Clause 15. The **operating times, operating sequence, flame detector operating characteristics, HTO detector operating characteristics and proved igniter operating value** shall be as declared in Table 1.

For **systems** providing **electronic disconnection** (Type 1.Y or 2.Y), the requirements of H.11.4.16 are still met.

18 Mechanical strength

This clause of Part 1 is applicable except as follows:

18.2 Impact resistance

18.2.4.1 Not applicable.

18.5 to 18.8 Not applicable.

19 Threaded parts and connections

This clause of Part 1 is applicable.

20 Creepage distances, clearances and distances through solid insulation

This clause of Part 1 is applicable except as follows:

Addition:

For the high-voltage side of electronic high-voltage **ignition sources**, the requirements of Clause 20 are not applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – Emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

This clause of Part 1 is applicable.

26 Electromagnetic compatibility (EMC) requirements – Immunity

See Annex H.

27 Abnormal operation

This clause of Part 1 is applicable except as follows:

27.3 Over-voltage and under-voltage test

Not applicable.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is applicable.

Figures

The figures of Part 1 are applicable

Annexes

The annexes of Part 1 are applicable except as follows:

Annex H (normative)

Requirements for electronic controls

H.6 Classification

This clause of Part 1 is applicable except as follows:

H.6.18.2

Addition:

The **reset** from **lock-out** function as specified in 11.102 is a **class B control function**.

H.6.18.3

Addition:

Burner control systems as specified in 11.3.101 to 11.3.113 inclusive are **class C control functions**.

H.7 Information

This clause of Part 1 is applicable except as follows:

Table H.1 (7.2 of the previous edition)

Modification:

Information		Clause or subclause	Method
52	Not applicable		
58a	Not applicable		
58b	Not applicable		
60	Not applicable		
<i>Modify the existing requirement:</i>			
71	Not applicable		
<i>Add the following additional requirement:</i>			
119	Defined state "out of operation"	H.26.8.2	X
<i>Add the following additional requirement:</i>			
121	The effect on solid-state outputs for motors, transformers, valves, etc. as a result of the tests of Clause H.26	H.26.2	X
<i>Add the following additional requirement:</i>			
136	Software fault/error detection time(s) for controls of software class C ^{12), 104)}	H.27.1.2.3	X
NOTES:			
<i>Additional notes:</i>			
¹⁰⁴⁾	The fault/error detection time is the period between the execution (after the fault has occurred), of the relevant software segment, either for function or for checking purposes and the completion of the declared control response.		

H.17 Endurance

This clause of Part 1 is not applicable.

See 17.16.101.

H.26 Electromagnetic compatibility (EMC) requirements – Immunity

This clause of Part 1 is applicable except as follows:

H.26.1 *Modification:*

The third paragraph is not applicable.

H.26.2 *Replacement:*

Compliance is checked according to the criteria described in each of the Subclauses H.26.4 to H.26.12 inclusive.

H.26.4 **Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests**

Addition:

The test shall be performed

- a) during stand-by time;
- b) during start-up period;
- d) in the **running position**;
- e) in the **lock-out** position.

The system shall tolerate harmonics and interharmonics including mains signalling at a.c. power port, so that, when tested in accordance with H.26.4, either it shall continue to function in accordance with the requirements of this document or it may proceed to **safety shut-down**, which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.5 Voltage dips, voltage interruptions and voltage variations in the power supply network

H.26.5.1.2 Test procedure for voltage dips and interruptions

Addition:

The test shall be performed three times in each of the following operating modes:

- a) during pre-purge or **waiting time**;
- b) during **start-up lock-out time(s)**;
- c) in the **running position**;
- d) in the **lock-out** position.

Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.

The system shall tolerate voltage dips and short interruptions in the electricity supply in accordance with the requirements of Table H.14.

Compliance shall be as follows:

- 1) Duration of half and one cycle of the supply waveform: it shall continue to function in accordance with the requirements of this document. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- 2) Duration of 2,5, 25 and 50 cycles: either it shall perform as in a) or it may proceed to **safety shut-down** followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

When the power supply is restored, the **system restart** shall comply with the requirements for a start-up sequence.

Requirement 2) can be ignored, provided that the power **failure** is less than 60 s and occurs within 60 s after call for heat. On restoration of the power, the programme may be continued from the point at which it was interrupted.

A shortened start-up sequence, for example, a start-up sequence without pre-purge or **waiting time**, is allowed, provided that the power **failure** occurs within 60 s after the end of the start-up sequence and is shorter than 60 s.

H.26.5.2 Voltage variation test

H.26.5.2.1 Test levels for voltage variations

The duration and test values in Table H.101 shall be applied.

H.26.5.2.2 Test procedure

Replacement:

The control shall operate according to the functional specification (see 11.3.105) at least within the voltage tolerance band of the rated voltage $+10\%$, and below -15% of the rated voltage the control shall stay safe.

The test apparatus and procedures shall be as described in IEC 61000-4-11. The duration of the voltage changes and the time for which the reduced voltages are to be maintained are given in Table H.101 and illustrated in Figure H.101. The rate of change of voltage shall be constant; however, the voltage is allowed to be stepped. The steps shall be positioned at zero crossing and shall be not larger than 10% of V_R . Steps under 1% of V_R are evaluated as constant rate of change of voltage.

The control, in the **running position**, is supplied at rated voltage, or at the lowest rated voltage of a rated voltage range. After approximately 1 min, the power supply voltage is reduced to a level such that the control ceases to respond to safety related inputs and/or drive safety related outputs (e.g. **flame signal**, fuel valve).

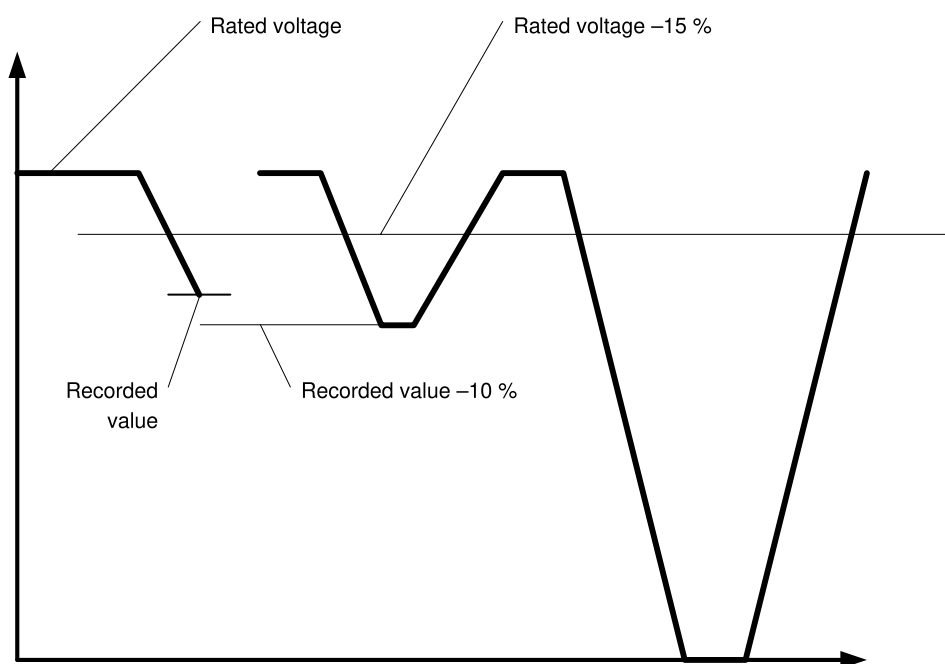
This value of the supply voltage is recorded.

Table H.101 – Timing of short-term supply voltage variations

Voltage test level	Time for decreasing voltage	Time at reduced voltage	Time for increasing voltage
Recorded value – 10 %	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %
0 V	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %

In the voltage range of **operation**, from rated voltage to 1,05 times of the recorded value, the control shall conform to 11.3.105 a). In the voltage range of **operation**, between 85 % of the rated voltage and 1,05 times of the recorded value, the control shall conform to 11.3.105 b).

For test purposes, precautions shall be taken to ensure that signals, e.g. from sensors or switches that can initiate a safety action and the presence of which normally may be independent of the supply voltage, are present at any level of the supply voltage. The signal may be simulated to prevent the **control** de-energizing the safety relevant output(s) as a result of disappearance of such input signals.



IEC

Figure H.101 – Voltage variation test

Each of the above tests is repeated three times in each of the following operating modes:

- a) during pre-purge or **waiting time**;
- b) during **start-up lock-out time(s)**;
- c) in the **running position**;
- d) in the **lock-out** position.

Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.

After the tests, the system:

- 1) shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**, or
- 2) shall either perform as in 1) or it may proceed to **safety shut-down** followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE Non-volatile lock-out excludes the use of system restart.

H.26.6 Test of influence of voltage unbalance

Not applicable.

H.26.8 Surge immunity test

H.26.8.3 Test procedure

Replacement of the second paragraph:

The test shall be carried out by subjecting the system to five pulses and with the voltage and current values listed in Table H.14 at intervals of not less than 60 s.

The five pulses of each polarity (+, –) and each phase angle as described in IEC 61000-4-5 are delivered in the following operating modes:

- a) 2 pulses with the system in the **lock-out** position;
- b) 1 pulse with the system in the **running position**;
- c) 2 pulses randomly applied during the start-up sequence.

The system shall tolerate voltage surges on the mains supply and relevant signal terminals, so that, when tested in accordance with H.26.8.3,

- 1) for the values of Table H.16 installation class 2, it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out** nor shall it **reset** from **lock-out**;
- 2) for the values of Table H.16 installation class 3 for all listed tests, either it shall perform as in 1) or it may proceed to **safety shut-down**, which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE Non-volatile lock-out excludes the use of **system restart**.

- 3) for the values of Table H.16 installation class 4 with line to earth on power supply only, either it shall perform as in 1) or 2) or it shall go into the defined state “out of **operation**” as declared by the manufacturer in accordance with Table 1, requirement 119.

For compliance criteria 1) and 2), after the tests of H.26.8.3, the surge protective components shall not be destroyed.

H.26.9 Electrical fast transient/burst test

H.26.9.3 Test procedure

Modification:

Replace the 2nd paragraph of Part 1 by the following:

*The test shall be performed for 20 cycles with the system having reached the **running position**, remaining in the **running position** for a minimum of 30 s within each cycle. The test shall also be performed for a minimum of 2 min with the system in the **lock-out** position and with the system in the stand-by position.*

The system shall tolerate electrical fast transient bursts on the mains supply and signal lines, so that, when tested in accordance with H.26.9.2,

- a) *for test level 2 of Table H.17: it shall continue to function in accordance with the requirements of this document. It shall neither go to **safety shut-down** or **lock-out**, not shall it **reset** from **lock-out**;*
- b) *for test level 3 of Table H.17: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**;*

NOTE Non-volatile lock-out excludes the use of system restart.

- c) *for test level 4 of Table H.17, either it shall perform as in a) or b) or it shall be set out of **operation** into a defined state as declared by the manufacturer in accordance with Table 1, requirement 119.*

H.26.10 Ring wave test

H.26.10.4 Test levels

Replacement:

Burner control systems are to be tested at two of the severity levels of the peak values of open-circuit voltage and short-circuit current of the surges, in accordance with Table H.18.

Table H.103 – Peak voltages

Maximum rated input voltage V	Severity ^{a b}					
	Severity level I		Severity level II		Severity level III	
	kV	R1	kV	R1	kV	R1
100	0,5	25	0,8	25	1,5	2,5
300	1,0	25	1,6	25	2,5	2,5
600	2,0	25	3,0	25	5,0	2,5

^a kV open-circuit – See Figure H.4 for R1
^b See Annex L for categories.

H.26.10.5 Test procedure

Additional subclauses:

H.26.10.5.101 Systems other than those operating at **SELV** are tested according to severity level II and severity level III respectively.

H.26.10.5.102 SELV systems are tested according to severity level I and severity level II respectively.

H.26.10.5.103 Each control is to be subjected to five impulses of each polarity, positive and negative (+ , -) and with phase relationships of at least 0°, 90°, 180°, and 270°, applied in turn between the power supply terminals of the control and between each of the load terminals, at intervals not less than 60 s.

H.26.10.5.104 For these tests, the control is to be energized at rated voltage. Approximately half of the tests are to be conducted with the control in the **lock-out** condition and the other half during other **operating sequences** which are considered to be most likely affected by the voltage or current surges.

H.26.10.5.105 After each of the severity level I tests for **SELV systems** and severity level II for **systems** other than **SELV**, the controls shall operate in accordance with item a) of H.26.10.5.101.6. After each of the severity level II tests for **SELV systems** and severity level III tests for **systems** other than **SELV**, the controls shall operate in accordance with any one of the criteria specified in H.26.10.5.106.

H.26.10.5.106 After each test, the control shall operate in accordance with either of the following:

- The control continues to operate in its normal **operating sequence** and declared timings.
- The control operates to de-energize the fuel flow means or both the fuel flow means and the **ignition source**.
- The control completes the current operating cycle with either the fuel flow means or both the fuel flow means and the **ignition source** de-energized and fails to start the subsequent cycle.
- The control completes the current cycle with either the fuel flow means or both the fuel flow means and the **ignition source** de-energized and initiates a new start-up procedure and thereafter operates in its normal **operating sequence** and declared timings.

- e) For the disturbances applied during the normal running condition with the flame being proved, the control may initiate a **re-ignition** procedure, if designed to do so, and thereafter operates in its normal **operating sequence** and declared timings.
- f) The control goes into **safety shut-down** condition.

H.26.11 Electrostatic discharge test

Additional subclauses:

H.26.11.101 Test conditions

Table H.103 – Test levels for electrostatic discharge

Assessment criteria	Severity level	Contact discharge	Air discharge
a)	2	4 kV	4 kV
b)	4	8 kV	15 kV

The **system** has to be tested in each of the following conditions:

- **start position**;
- **running position**;
- **lock-out** position.

The system shall tolerate electrostatic discharges so that, when tested,

- a) *for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;*
- b) *for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.*

NOTE 1 **Non-volatile lock-out** excludes the use of **system restart**.

NOTE 2 In Canada and the USA, accessible parts can include parts which can be contacted during installation and service.

H.26.12 Radio-frequency electromagnetic field immunity

H.26.12.2.1 Test levels for conducted disturbances

The tests on interface cables are not carried out if the manufacturer explicitly specifies that the length of that cable shall not exceed 1 m.

H.26.12.2.2 Test procedure

Addition:

*The **system** shall be swept through the complete frequency range at least once with the **system** in each of the following operating modes:*

- **start position**;
- **running position**;
- **lock-out** position.

The **system** is subjected to two sweeps of the frequency range from minimum to maximum at the indicated severity level. One sweep is performed with the **system** in the **lock-out** condition. The other sweep is performed during the remainder of the **operating sequence**.

The system shall tolerate conducted electromagnetic fields so that, when tested,

- a) for test level 2 of Table H.19: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- b) for test level 3 of Table H.19: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.12.3 Immunity to radiated disturbances

H.26.12.3.2 Test procedure

Addition:

The **system** has to be swept through the complete frequency range at least once with the **system** in each of the following operating modes:

- **start position**;
- **running position**;
- **lock-out position**.

The system shall tolerate radiated electromagnetic fields so that, when tested,

- a) for test level 2 of Table H.20 and Table H.21: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;
- b) for test level 3 of Table H.20 and Table H.21: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.13 Test of influence of supply frequency variations

H.26.13.3 Test procedure

Addition:

The test shall be performed at least once with the system in each of the following operating modes:

- **start position**;
- **running position**;
- **lock-out position**.

The system shall tolerate supply frequency variations such that, when tested,

- a) for test level 2 of Table H.22: it shall continue to function in accordance with the requirements of this document. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**. Variation in programme timings shall not exceed the percentage of applied frequency variations;

- b) for test level 3 of Table H.22: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.14 Power frequency magnetic field immunity test

H.26.14.3 Test procedure

Addition:

The test shall be done at least once with the system in each of the following operating modes:

- **start position;**
- **running position;**
- **lock-out position.**

The system shall tolerate power frequency magnetic fields so that, when tested,

- a) *for test level 2 of Table H.23: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**.*
- b) *for test level 3 of Table H.23: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart** or, if in **volatile lock-out**, it may proceed to a **system restart**.*

NOTE 101 **Non-volatile lock-out** excludes the use of **system restart**.

H.26.15 Evaluation of compliance

This subclause of Part 1 is not applicable.

H.27 Abnormal operation

This clause of Part 1 is applicable except as follows:

H.27.1.1.3

The third paragraph of a) is not applicable.

Add the following new item:

- h) For **proved igniter systems**, the **proved igniter operating value** shall not exceed or be less than, as applicable, the values declared by the manufacturer (Table 1 (7.2 of the previous edition), requirement 132).

H.27.1.1.5 Electronic circuit fault conditions

Table H.24 (Table H.27.1 of the previous edition) – **Electrical/electronic component fault modes table**

Modification:

Add to the end of footnote i in Table H.24 the following:

The nominal cycles are 250 000.

In Canada and in the USA, the nominal cycle is 100 000.

Replace note 12 as follows:

- m) For the assessment according H.27.1.1.3, the short-circuit **failure** mode is excluded if the requirements of Clause 20 are met. For the assessment according H.27.1.2, the short-circuit **failure** mode is excluded if the requirements of Clause 20 for **overvoltage category** III are met.

Modification:

Replace in the third bulleted item in footnote i, “a minimum of 100 000 cycles” by “250 000 nominal cycles (100 000 nominal cycles in Canada, Japan and in the USA)”.

Add, after the fourth bulleted item in footnote i, the following:

or

- the switching sequence of the relay contact configuration is integral to the part of the **class C control function**,
- and
- the contact function is switching under normal **operation** without load (no current flowing during make and current flowing during break shall be lower or equal 5 % of rated contact current),
- and
- the contact function is disconnecting the load under abnormal operation of the **burner control system** to reach **safety shut-down**,
- and
- the relay complies with Clause 17 at 1 000 000 cycles (load only at break) without resulting in short-circuit **failure** however applying 5 % of rated contact current,
- and
- the **control** complies with the requirements of 11.3.5.2.1 (measures to prevent **common cause errors**).

H.27.1.2 Protection against internal faults to ensure functional safety

H.27.1.2.2 Class B control function

This subclause of Part 1 is applicable for the **reset** from **lock-out** control function.

H.27.1.2.3 Class C control function

The modification applies to the French text only.

H.27.1.2.3.1 Design and construction requirements

Replacement of the last paragraph by the following:

The circuitry and the construction of the **system** shall be such that they meet the requirements of 11.3.101 to 11.3.113 inclusive, 11.4.101 to 11.4.107 and 11.101 and shall be appraised according to the requirements to H.27.1.2.3.2, H.27.1.2.3.3 and H.27.1.2.4 and under the test conditions and criteria of H.27.1.2.5.

H.27.1.2.3.2 First fault

Replacement:

Any **fault** (see Table H.21) in any one electronic component or any one **fault** together with any other **fault** arising from the first **fault** shall result in either

- a) the **system** proceeding to **safety shut-down** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 (terminals for fuel flow means are de-energized) and it remains in this condition as long as the **fault** appears; or
- b) the **system** proceeding to **lock-out** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 provided that the subsequent **reset** from **lock-out** under the same **fault** condition results in **lock-out**; or
- c) the **system** continuing to operate, the **fault** being identified during the next start-up sequence, the result being a) or b); or
- d) the **system** remaining operational in accordance with Clause 15.

For automatic **burner control systems** design for non-permanent **operation**, c) is applicable whereas c) is not applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.3.3 Second fault

Replacement of the third paragraph by the following:

For automatic **burner control systems** design for non-permanent **operation** the second **fault** shall be considered according to option a) whereas option b) is applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.4.2 Second faults introduced during lock-out or safety shut-down

Addition:

During assessment, the first **fault** shall not be considered to occur within 24 h after **lock-out** or **safety shut-down** is reached without an internal **fault**.

NOTE 101 While conducting this test, the **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. It is not necessary to wait 24 h before applying the **fault**. If the **fault** was applied before 24 h and unacceptable results were obtained, the **fault** can be applied 24 h after reaching **lock-out** or **safety shut-down**.

The “safe situation” as mentioned in H.27.1.2.4.1 is defined:

- as valve terminals remaining de-energized;
- as valve terminals are energized not longer than the safety time.

NOTE 102 For independent **flame detector** or **HTO detector** devices, the de-energization of the **flame signal** or **HTO signal** output resulting in a “flame off” or “HTO off” signal is equivalent to these definitions.

H.27.1.2.4.3 Second fault introduced during defined state

Addition:

While conducting this test, the second **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. It is not necessary to wait 24 h before applying the second **fault**. If the second **fault** was applied before 24 h and unacceptable results were obtained, the initial **fault** shall be applied and then wait 24 h before applying the second **fault**.

Annex J (normative)

Requirements for thermistor elements and controls using thermistors

J.1 Scope

This clause of Part 1 is applicable except as follows:

J.1.1.1 *Addition:*

NOTE 101 A hot surface igniter is not considered to be a thermistor.

Annex AA
 (informative)

Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Table AA.1 – Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Item	Subclause	Remarks
Multitry system	2.2.107	Allowed or not
Automatic recycle	2.3.101	Allowed or not
Flame detector response time	2.3.103	Maximum time
Self-checking flame detector	2.3.105	Required or not
Flame detector self-checking rate	2.3.106	Minimum rate
Flame failure lock-out time	2.3.107	Maximum time
Flame failure response time	2.3.107	Maximum time
Flame failure re-ignition time	2.3.108	Maximum time
Ignition time	2.3.111	Maximum time
Non-volatile lock-out	2.3.112.1	Required or not
Volatile lock-out	2.3.112.2	Allowed or not
Main flame establishing period	2.3.113	Maximum time
Pilot flame establishing period	2.3.114	Maximum time
Post-ignition time	2.3.115	Maximum time
Pre-ignition time	2.3.116	Maximum time
Proved igniter	2.3.117	Required or not
Purge time	2.3.118	Minimum time
Post-purge time	2.3.118.1	Minimum time
Pre-purge time	2.3.118.2	Minimum time
Re-ignition	2.3.119	Allowed or not
Recycle time	2.3.120	Minimum time
Start-up lock-out time	2.3.125	Maximum time
Waiting time	2.3.126	Minimum time
Valve open period	2.3.127	Maximum time
Valve sequence period	2.3.128	Maximum time
Defined temperature limit for HTO	2.3.132	Minimum temperature
HTO detector response time	2.3.134	Maximum time
System for permanent operation	2.5.101	Required or not
System for non-permanent operation	2.5.102	Allowed or not

Annex BB (informative)

Specific regional requirements in Japan

BB.1 General

For the purposes of this International Standard, the specific regional requirements given as follows are applicable in Japan.

BB.1.1.101 Addition:

NOTE This regional Annex BB shows that JIS C 9730-2-5:2010 is identical to IEC 60730-2-5:2000+AMD1:2004 based on ISO/IEC Guide 21-1,8.2 Table 1, as Designation "identical" a) and b), Abbreviation "IDT".

BB.1.5 Normative references

Subclause 1.5 is applicable with following modifications:

Reference in Subclause 1.2 of Part 1 and 1.5 of this document	Replaced by	IDT/MOD
IEC 60384-16:2005	JIS C 5101-16:1999	IDT
IEC 60730-1 Ed. 5.0:2013	JIS C 9730-1:2016	MOD
IEC 60068-2-6	JIS C 60068-2-6:1999	IDT
IEC 61558-2-6, IEC 61558-2-16	JIS C 61558-2-6, IEC 61558-2-16	MOD

Annexes

Annex H – Requirements for electronic controls

H.26.10 Ring wave immunity test

This subclause is not applicable in Japan.

Table BB.1 – Comparison between JIS and adopted international standard

JIS C 9730-2-5:2010					IEC 60730-2-5:2010+AMD1:2004/Ed.3		
(I) JIS		(II) International standard No.	(III) International standard		(IV) Evaluation between JIS and International standard		(V) Reason and future changes
Clause No.	content		Clause No.	content	Evaluation In clause	Different technical content	
H.26	EMC		H.26	Same as JIS	Modified	Align with JIS C 9730-1 clause No.	To apply clause No. of the newest IEC documents.
Annex AA	Note 7)	-	Annex AA Note 7)	Same as JIS	Modified	Excluded relays certified in accordance with Clause 17.	The IEC has no Japanese deviation. (For IEC 60730-1:2013,Table H.24 footnote i),it is revised, Japanese practice is the same as Canada and USA.)
Total evaluation to issue between JIS C 9730-2-5:2010 and IEC 60730-2-5:2010+AMD1:2004: IDT							

Bibliography

Bibliography of Part 1 is applicable except as follows:

Addition:

IEC 60947 (all parts), *Low-voltage switchgear and controlgear*

IEC 60989:1991, *Separating transformers, autotransformers, variable transformers and reactors*

IEC 62282-3-100, *Fuel cell technologies – Part 3-100: Stationary fuel cell power systems – Safety*

ISO 13577 (all parts), *Industrial furnaces and associated processing equipment*

JIS C 9730-2-5, *Automatic electrical controls for household and similar use – Part 2-5: Particular requirements for automatic electrical burner control systems*

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